# ACID RAIN OVERSIGHT

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# HEARINGS

BEFORE THE

SUBCOMMITTEE ON
ENERGY AND POWER

OF THE

COMMITTEE ON
ENERGY AND COMMERCE
HOUSE OF REPRESENTATIVES

ONE HUNDREDTH CONGRESS

SECOND SESSION

MAY 26, JUNE 15, 20 AND 22, 1988

**Serial No. 100–222**

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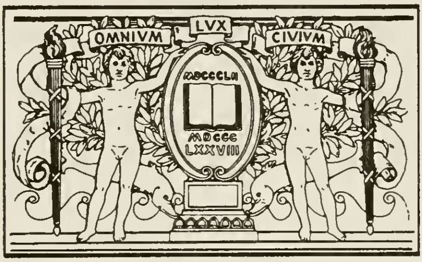

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# ACID RAIN OVERSIGHT

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## THURSDAY, MAY 26, 1988

House of Representatives,
Committee on Energy and Commerce,
Subcommittee on Energy and Power,
*Washington, DC.*

The subcommittee met, pursuant to notice, at 1 p.m., in room 2322, Rayburn House Office Building, Hon. Philip R. Sharp (chairman) presiding.

Mr. Sharp. The subcommittee will come to order.

Today we begin hearings on acid rain and the proposals referred to our subcommittee.

Although the legislative process rarely gives us the luxury of decisions based upon perfect information, the gaps in the public record on acid rain are troubling and the significant cost of some of the proposals, especially for those of us in the Midwest, make it all the more important that we act on information, not anecdote or faith.

The question of acid rain begins with science, which is why our inquiries today begin also with science. Before leaping into the vortex of the acid rain legislative arena, we ask the threshold question: What is the nature and the extent of the problem?

That is the question that the scientific community must address with special candor where the answers may not yet be clear. As legislators, we know that the scientific community can educate us and guide us but that we ask the impossible when we attempt to delegate our choices to them.

These choices involve billions of dollars, potentially substantial rate increases for many ratepayers, cost differentials for energy-sensitive industries that may send those industries abroad and the loss of jobs that may accompany this added regulation of the Nation's primary fuel source, coal.

This subject arouses passionate debate and it may be that passion on both sides which makes it difficult to achieve a consensus. It is my hope that this panel will give us a scientific basis on which to build sound policy.

The Chair now recognizes our distinguished Republican colleague from Texas, Mr. Fields, for an opening statement.

Mr. Fields. Thank you very much, Mr. Chairman.

Mr. Chairman, acid rain is a subject about which we have heard much testimony. From my point of view the facts are pretty clear. If there is environmental damage from acid deposition, it is, at the most, a regional problem. Furthermore, the region in which it may be a problem does not include Texas. Moreover——

Mr. SHARP. You're lucky.

Mr. FIELDS. I'm sure we are.

Moreover, the problem which that region may be experiencing is not caused by Texas. Mr. Chairman, for the record, I'd like to note the following. In the June, 1984 Office of Technology Assessment Report, which is entitled "Acid Rain and Transported Air Pollutants," page 93, there are two maps of the United States which show the average 1980 emission rates for sulfur dioxide from utility and industrial sources. I am going to ask unanimous consent that the maps be included in the record along with my full statement.

Mr. SHARP. Without objection.

Mr. FIELDS. What I want you to note is that for utility sulfur dioxide emissions, Texas averages less than 0.6 pounds of sulfur dioxide for each million Btu's of heat input. However, the State of Minnesota—and there have been some representatives which have tried to blame Texas for their acid rain problem—averaged between 1.2 and 1.5 pounds of sulfur dioxide per million Btu's of heat input. I also draw your attention to the fact that under H.R. 2666, the bill of the gentleman from Minnesota, Mr. Sikorski, utilities would have to achieve a State average emission rate of 1.2 pounds of sulfur dioxide in the second phase. According to the data I have, Texas is already there. Minnesota might have a problem.

My point is that States which have overriding concerns about acid deposition ought to look to themselves and to their immediate neighbors before pointing the finger at areas that are 1,300 miles away.

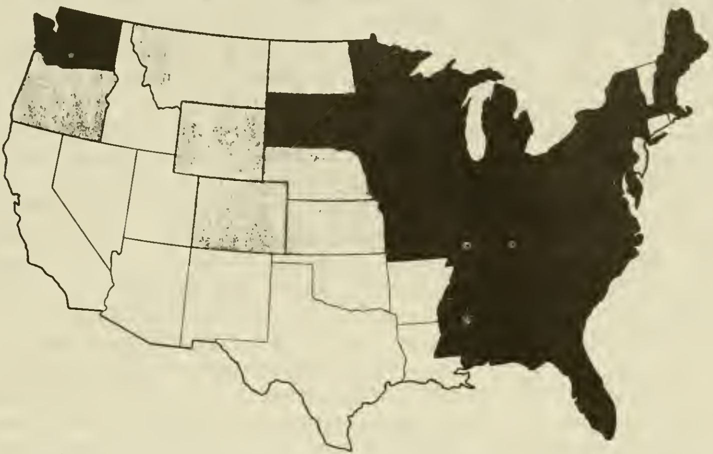
Mr. Chairman, even though I sometimes feel like we have heard more than enough about acid rain, I want to commend you for conducting this hearing for the purpose of establishing a scientific framework for this subcommittee's future deliberations on specific legislative proposals. If this effort provides rational illumination of the issues, then I would say that this hearing is well worth it.

Mr. Chairman, I would like to provide some illumination on the situation in Texas. According to the Texas Air Control Board, although monitoring indicates that rainfall with below normal pH does occur in Texas at various times, Texas does not currently have any identified environmental effects linked to acid deposition. This is important to note because past witnesses have based their assertion that acid rain damage is occurring solely on the fact that below normal pH rainfall occurs. Just like the presence of a skin mole does not necessarily indicate the presence of a malignancy, the fact of occurrence of acid rain does not necessarily indicate environmental damage. Both are situations to monitor and Texas is monitoring its environment.

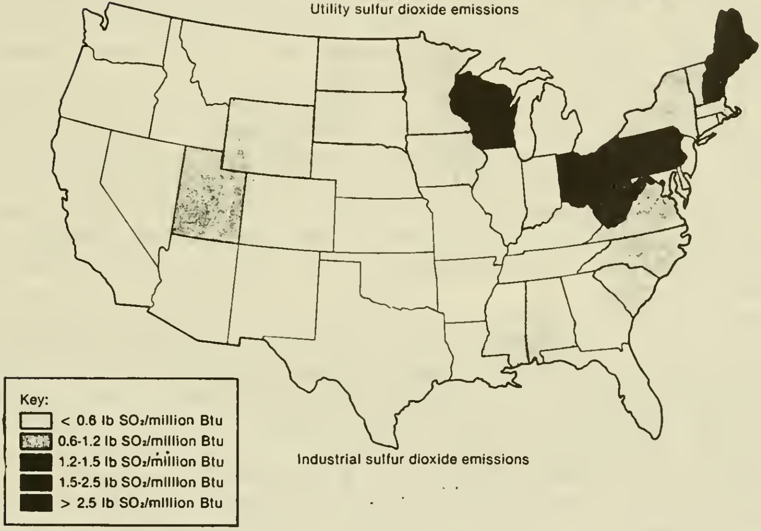
Furthermore, Texas Water Development Board studies indicate that waters in East Texas do not show signs of damage from acid rain and that very few sites appear vulnerable to future acid deposition effects. The Texas Parks and Wildlife Department also has not found any evidence of fish kills or other effects that might be attributable to acid rain. As we proceed in these deliberations, I hope that the evidence from Texas will be included as part of the scientific framework. Again, I thank you very much, Mr. Chairman.

[The maps referred to follow:]

**Figure 34.—Average 1980 Emission Rates for Sulfur Dioxide From Utility and Industrial Sources** (lb $SO_2$/MMBtu)



Utility sulfur dioxide emissions


Key:
☐ < 0.6 lb SO₂/million Btu
▨ 0.6-1.2 lb SO₂/million Btu
■ 1.2-1.5 lb SO₂/million Btu
■ 1.5-2.5 lb SO₂/million Btu
■ > 2.5 lb SO₂/million Btu

Industrial sulfur dioxide emissions

SOURCE: E. H. Pechan & Associates, from Energy Information Administration data (EIA forms 4 and 423), and EPA National Emissions Data System (NEDS).

Mr. SHARP. I thank the gentleman for his comments. The Chair will recognize our other colleagues for opening statements in hopes that after the two main opening statements we can keep them reasonably short.

The gentleman from Oklahoma, Mr. Synar.

Mr. SYNAR. I got the message. Thank you, Phil.

The acid rain cloud continues to hang over Congress and I hope that we are able to make some real progress towards resolving this issue over the next several weeks.

Over the years the acid rain debate has centered on the impact of $SO_2$ emissions on a variety of natural and man-made resources and these questions have been what has been the size of the emission reductions that are necessary and within what time frame should those reductions be accomplished. We could debate these issues until the next century, waiting for definitive scientific results. I believe however that the time has come to stop dragging our feet and start some meaningful action. We have a tendency around here to look at these various air pollution issues as if they were unrelated. The fact is that emissions of $SO_2$ and $NO_x$ and VOC's and other pollutants create what is a complex chemical soup that contributes to a variety of serious air pollution problems.

It may be fruitless to require a 50 percent reduction in sulfur dioxide emissions if our goal is protecting high elevation forest. It appears ozones perhaps in some combination with acid components is the problem there.

In controlling the VOC's that contribute to the ozone formation, we are also reducing some of our air toxics like benzene that are known or suspected carcinogens, and reducing fossil fuel burning through conservation measures will not only help reduce pollution but it will also have a long term benefit of addressing what may be our greatest environmental dilemma facing us in the 21st century, and that is the rapid warming of our atmosphere through the greenhouse effect.

The point is this: We can sit and we can wait for perfect information or we can take steps to get reasonable and responsible emission reductions while continuing to study the problem. We can take a piecemeal approach of looking at one air pollution issue as separate from all others or we can take steps to reduce emissions of man-made pollutants to begin cleaning up our environment.

This does not mean that we need to institute a draconian program of getting reductions at any cost. It does mean that we will need to initiate a realistic program to get meaningful emission reductions over both the short and long term.

Mr. SHARP. I thank the gentleman.

The gentleman from Washington.

Mr. SWIFT. I ask unanimous consent to insert a statement in the record.

Mr. SHARP. Without objection.

Mr. SWIFT. I come from a part of the country that has relatively little impact from acid rain or on acid rain. What I know is if you bring an acid rain bill up on the floor today it is going to pass overwhelmingly and it should.

I have been concerned however, as someone from another region of the country, with the economic impacts some acid rain proposals can have on one region of the country—it is not the Midwest's fault that it doesn't have a Columbia River like I have in the Pacific Northwest with which to generate electricity. It is not a case of putting a penalty on some region of the country for it doing evil—it is simply that pollution is a natural outgrowth and acid is a natural outgrowth of what they've had to do to produce electricity—so I have had some sympathy with the region.

That region generally, however, has approached acid rain from the standpoint of stonewalling the legislation. Clear, overwhelming support for legislation on acid rain exists in the Congress and it can't be kept from getting to the floor forever. I think I am like a number of my colleagues here who want to be very, very careful about how we deal with the economy of the Midwest. We do not want to harm it. It will harm the economy of the whole country if we do that, but we have got to get some help from people within the Midwest in letting some legislation flow. If we do not, then those of us who believe we've got to move ahead with acid rain legislation have nowhere else to go but to those proposals which I feel have too extreme an economic impact on a single region of the country.

Those of us who have failed to sign on to acid rain legislation in the past because we felt it was too extreme, for many of us, are beginning to lose patience with the stonewalling on the part of the Midwest. We want to see some kind of a response that there is a willingness to move on this legislation, to get started in dealing with the acid rain problem and then we'll be there to try and see that we do this in a fashion that is not going to destroy the economy of one region of the country and ravish the ratepayers of that region of the country. But if we get nothing forthcoming in the way of some kind of willingness to deal with this out of that region of the country, our alternatives are limited to one—and it is the Waxman bill, the Sikorski bill, the Mitchell bill, what have you—those are the only things on the table.

I am very interested in what the scientists have to say. I will be very surprised if they tell us there is no acid rain problem and I'll be very interested to see if what I sense is—that there is a growing realization in the Midwest that the historic tide is running against stonewalling acid rain legislation and I just want them to know there are allies from other parts of the country that are willing to help the Midwest avoid economic disaster along with acid rain legislation, but we can't be patient much longer—and I yield back my time.

Mr. SHARP. The Chair certainly wants to thank the gentleman from Washington for his statement and his recognition of the regional difficulty that some of us face and his willingness to listen to argument and information about the problem and how it might be handled in ways that would be less costly to us. We appreciate his open-mindedness, those of us from the Midwest who are going to be directly impacted by anything, any decision the Congress might make about this.

The Chair now recognizes the gentleman from Ohio, Mr. Oxley.

Mr. OXLEY. Thank you, Mr. Chairman. I want to welcome our panel here today. It is always helpful to get the scientific community's recommendations and determinations in this area. I also appreciate the gentleman from Washington's comments with regard to his sensitivity to those of us from the Midwest.

I would say that we have not been without our efforts at trying to deal with this problem and in fact have made some progress. The voters of Ohio, for example, in 1984 approved a rather substantial bond issue that would fund clean coal technology research. We have conducted perhaps more than any other State some of the most comprehensive and innovative programs to deal with clean coal technology and those are ongoing and something that unfortunately get very little publicity at least inside the Beltway.

Second, we have, I think, made a significant reduction in our $SO_2$ emissions, compared to what for example the Canadians have done. It is interesting that the Canadians would come to this country with some thought perhaps of stampeding the administration and the Congress into stronger acid rain controls when in fact they hardly came with clean hands themselves. For those of us in law school who remember equity and remember the "clean hands doctrine," clearly the Canadians were far from it, particularly with the substantial increase in emissions from the Ontario power plant among others and the fact that they have very few emissions controls in that country. I felt on fairly comfortable grounds when Mulroney met with President Reagan and, while there was some discussion about the issue, there was certainly no caving in to the Canadians on that issue. As a matter of fact, the agreement that was struck still holds. The one that special envoy Drew Lewis put together with former Premier Davis is still ongoing, and I think it has made some substantial progress.

We have not only a scientific determination to make but obviously a political one as well. For those of us who do represent the Midwest, not only do we have to be concerned about our image and whether in fact our image is a bad one, and I suspect in some quarters it is, but also whether in fact we are in a position to, through an act of the national Congress, wreak havoc on the economy of a very productive segment of this country.

I was particularly pleased, finally Mr. Chairman, with the NAPAP's interim assessment report, which I think put to rest some of the most vitriolic criticism of the whole question of acid rain and really set out some sound scientific basis for us not to necessarily panic and feel that we have to enact some kind of an emergency statute to deal with the issue. These people studied it comprehensively and I suspect that their report, while controversial in some quarters, was accurate. We are looking forward to the final report from the NAPAP group, and I thank the Chair and yield back the balance of my time.

Mr. SHARP. I thank the gentleman from Ohio and look forward to working with him as a Midwesterner on this issue.

We are going to have a number of our colleagues from the Energy and Commerce Committee stop in today and join us, and we'll try to afford them an opportunity to ask questions after members of the subcommittee have had their opportunity.

I want to welcome now a colleague, Mr. Cooper, who has authored one of the legislative proposals and is one of our welcome full committee members. We will be delighted to have his participation.

[The prepared statements of Mr. Bilirakis and Mr. Bruce follow:]

### Prepared Statement of Hon. Michael Bilirakis

I would like to thank our chairman for scheduling today's hearing on the science of acid rain.

The controversy surrounding acid rain and the legislation that has been introduced to address the emission of precursors is evident. As a member of the Health and the Environment Subcommittee last Congress—I am all too familiar with the sensitive nature of the topic, the costs involved, and, indeed, the emotional response that clean air legislation is capable of generating.

Underlying the issue of legislation, however, has always been the matter of scientific justification. Legislation to limit the emission of sulfur dioxide and nitrogen oxides is based on the expectation that a reduction in such emissions will reduce acid deposition. Moreover, the expectation underlying most legislation that has been introduced is that a 8 to 12 million ton reduction in sulfur dioxide and a 2 to 4 million ton reduction in nitrogen oxides will produce an appreciable increase in environmental quality.

The state of scientific evidence on acid rain is therefore crucial. While it is never possible to act with complete certainty—it is incumbent on Congress to investigate whether the legislative solutions it creates are based on practical and realistic expectations.

In brief, we cannot shy away from examining the issue of "cause and effect." Will a certain limit on emissions produce a beneficial effect on deposition? How much of an effect will be produced? Will reducing emissions help restore acidified lakes and streams? Or, if restoration is not practical, will reducing emissions help prevent further damage? What will be the net effect of reducing emissions on the acidity of rainfall?

These questions have been examined for many years, but I feel it is vital that we closely re-examine such questions in light of current scientific evidence. Certainly, it is not possible for us to become "overnight scientists" but stripping aside the emotions of the acid rain debate leaves a core of scientific theory.

On a more parochial level, I am also interested in scientific evidence concerning Florida and the Southeast. I am familiar with the EPA's report on acid deposition in Florida lakes and the more recent study of streams. Let me say that I was disturbed by the indication that up to 73 percent of the stream reaches in swampy areas of Florida are acidic.

Although the witnesses may not be able to fully address the "cause and effect" issue in Florida, I would be interested in their comments on the available data. While acid rain and clean air legislation is national in scope, I believe each member of this panel is concerned with matters affecting his home State and region.

Altogether, I hope that today's hearing will serve to update subcommittee members on the scientific theory. While it is doubtful we will soon become "Mr. Wizards of acid deposition theory," it is clear that the choices we make on legislation are dependent on scientific studies and the resulting analysis of the costs and benefits of emission control measures.

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### Prepared Statement of Hon. Terry L. Bruce

Thank you, Mr. Chairman for providing an opportunity for this subcommittee to hear from a panel of scientific experts on acid rain. It seems as if there is "conclusive scientific evidence" to support almost every imaginable viewpoint on this issue. I appreciate the opportunity to hear from these five acknowledged experts today.

I know that my visits to the Illinois Department of Energy and Natural Resources have been very helpful to me in framing my concerns on the scientific issues of acid rain. I remain concerned about the strength of the link between emission sources and the pollutant receptor sites. Before we undertake a major policy change I believe that this link ought to be well understood and generally agreed upon. I look forward to exploring that today.

As a member of the Group of Nine, I have spent a considerable amount of time on the question of ozone and carbon monoxide control. I understand that ozone and its precursors play a significant role in the formation of acid rain in the atmosphere. I would like to explore the benefits of existing and proposed ozone control measures in curbing acid rain.

Mr. Chairman, I commend you for holding a hearing on the scientific basis for further action on this issue. Thank you.

Mr. **Sharp.** We have decided to limit ourselves to one panel today so that we have a chance to gain a little better understanding of the issues that are before us, but we have made sure that the witnesses invited all are of a scientific background. All have been involved in the scientific questions related to acid rain or acid deposition, and in fact represent a variety of points of view with respect to the science on this question, as I understand it. At least that will become perhaps evident as we proceed.

First, we have Dr. James Mahoney, Director of the National Acid Precipitation Assessment Program, NAPAP; Dr. Ellis Cowling, Associate Dean for Research with the College of Forest Resources at North Carolina State University; Dr. George Hidy, Vice President and Director of Environmental Studies with the Electric Power Research Institute; Dr. James Galloway, Associate Professor with the Department of Environmental Science at Clark Hall, University of Virginia, and Dr. Robert Friedman, the Project Director for Ocean and Environmental Program with OTA.

Gentlemen, I think you are all familiar with our procedures. We will be more than pleased to make a part of our written record your written statement and documents you wish to include with it and we welcome at this point an oral summary of your testimony.

We appreciate the fact that we sent you some written questions and we're asking you in a sense to reshape knowledge that you already have but we are also aware that we gave you very little time in which to prepare. We will try to be understanding of the fact that we imposed a very short deadline upon you, but nonetheless hope that you can seriously help us address the questions that various committee members will have.

With that, Dr. Mahoney, we'll be happy to hear from you.

## STATEMENTS OF JAMES R. MAHONEY, DIRECTOR, NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM; ELLIS COWLING, ASSOCIATE DEAN FOR RESEARCH, COLLEGE OF FOREST RESOURCES, NORTH CAROLINA STATE UNIVERSITY; GEORGE HIDY, VICE PRESIDENT, ELECTRIC POWER RESEARCH INSTITUTE; JAMES GALLOWAY, ASSOCIATE PROFESSOR, DEPARTMENT OF ENVIRONMENTAL SCIENCE, UNIVERSITY OF VIRGINIA; AND ROBERT FRIEDMAN, PROJECT DIRECTOR, OCEAN AND ENVIRONMENT PROGRAM, OFFICE OF TECHNOLOGY ASSESSMENT

Mr. **Mahoney.** Thank you, Mr. Chairman. I appreciate the invitation to come and express our summarized scientific knowledge for your use. I appreciate your comment about the shortness of time. We've done the best we can to organize the information available to be useful for the subcommittee today. My statement is divided into three parts in response to your request.

I want to speak for just a moment about NAPAP and its responsibilities. Next, I want to address the questions of what do we know now versus what will we know by 1990 when we finish our work and publish the Integrated Assessment, which we are required to do under the statute. And then, finally, with that as background, I want to take the majority of my time to speak directly about the questions you posed in your invitation to testify.

Beginning with just a word about NAPAP, NAPAP has the statutory responsibility to develop comprehensive scientific, technological, and economic information related to acidic deposition.

NAPAP's scope altogether includes the sources of emissions; the atmospheric processes involved with them; the geographic areas of impact; the dose-response mechanisms related to acid deposition; the extent and severity of effects associated with the problem; the time sensitivity of the effects—and I might note that's a key matter—what are the rates of change that we believe we may see for better or for worse; the costs of various controls; and, finally, the benefit evaluations, the best means we can provide to try to organize the expected improvements or reductions of risk that might result from one or another kind of control-measure plan which would be developed.

To discharge these responsibilities, NAPAP must be comprehensive in its view. It must be credible, both to the scientific community, because that is its basis, and to all of its users. And it must itself be neutral, as regards the policy choices.

I want to make clear our view is to present the information to you and to all others who would view it in the way best suited to provide credible background for the policy choices you all then have to address.

NAPAP will release a summary plan for its 1990 Integrated Assessment very soon, within the next 3 months this summer. And next year we will be publishing a series of comprehensive state of science and state of technology reviews, covering all of the major aspects of the acidic deposition issue.

Those summaries will be presented and broadly reviewed in a major international scientific conference we'll hold here in the States, but with a very heavy participation from all technical points of view in that process.

Finally, and with all of that as background, a careful plan for the assessment this year and a careful review of all of the information which has now started and is going forward for next year, we will publish our Integrated Assessment drawing this all together, including the views of various control technology approaches in the 1990 Integrated Assessment, responsive to the requirement under the statute.

I'd like to turn now and talk about the issue of what we know now and what we expect we would know differently over these next 2 years.

First of all, I note that a great deal of technical information has been developed in the last few years. As a result, some views that were expressed back, I would say, in the late 1970's and early 1980's have been confirmed. Other views, in fact, have been changed substantially.

We continue our work now. We believe that there is significant new information to shape up our present perspective that will come in the short term. And we believe that there are four types of new information that will become available over these new 2 years in our program. I'd like to speak about those just for a moment.

First of all, field studies and model analyses of the time scale of change of effects, especially relative to aquatic systems, the lakes and streams, are now underway intensively.

These critical studies of the possible changes, how quickly they would occur, as I say, for better or for worse, depending upon deposition levels, where they would occur, and their importance are now underway and will be summarized beginning next year and summarized fully in the 1990 assessment to come.

Second, we have now in field evaluation a state-of-the-art—in fact, two state-of-the-art massive computer models dealing with the atmospheric chemistry and transport issues, which are central to understanding the real relationships between sources and receptors as far as acid rain in concerned.

We know the broad picture, but we don't really know the mechanisms now well enough to define relationships between individual source regions and the sensitive receptor regions. Our view is that we will have much more information suitable for making what I would call effective choices of strategies among the various options as these models are exercised in our on-going work.

Third, we have a major increase in emphasis on the combined issue of acidic species. That is, acid rain and the oxidant problem, which is well known. We expect to see intensive studies of the combined control problem brought forward. We will be doing that in our work over the next 2 years.

We view that to be especially important, because some strategies aimed at oxidant control don't do anything for the acid rain problem and some strategies even can have a counter-productive effect. And I'll describe that a bit more in a minute.

Fourth in the categories of new information, we are drawing together for the Integrated Assessment a view of the broad range of available control technologies and emerging control technologies. And we believe the view of the suite of possible technologies is very important for the addressing of choices among alternate routes to control.

I'd like to turn and speak very briefly, and the rest will be in my statement, as to our current understanding of effects levels.

And I'd note that my summary here will be only a paraphrase of those matters covered in the 1987 Interim Assessment released by NAPAP, an extensive study which was prepared by more than 50 scientific authors and reviewed by a very wide set of reviewers, including over 60 drawn from all walks of scientific and technological life on the United States side and the Canadian side and others.

First of all, about surface waters. Acid rain effects are generally recognized to occur in some fraction of surface waters in geologically sensitive regions, particularly in eastern North America.

Surface water chemistry is, in fact, influenced by many sources and many causes, in addition to acid rain. But I don't believe anyone would disagree that acid rain is an important factor in surface water acidity.

Up until this time, most of NAPAP's watershed work has been aimed at developing the survey of current surface water conditions. And we believe that that survey is now well in hand and is already reported and will continue to be reported.

NAPAP's research is now much more directed in the surface water area to this question of time rate of change, both for continued adverse impact and for recovery. And we believe the specific information, based on field studies for time rate of change, is critically important for the development of an evaluation of various strategies related to different deposition levels in the future.

Forests is an issue. In the last few years, the studies available have indicated that the principal pollutant of concern in the case of forest stress is ozone. This is not a statement that the acid species, sulfur and nitrogen, are not important.

Indeed, the studies are continuing, and there are major programs related to the question of soil mediated effects. That is, deposition onto the ground and uptake, finally, of the species through the root system.

However, given what we know now, our attention would be addressed much more to ozone than to sulfur species. We have major work underway on the broad forest response question, and we will be reporting on that, of course, as well, next year in the state of science work and in 1990 in our Integrated Assessment.

Agricultural crops have been studied. So far, the response of crop plants to acid deposition on a regional scale indicate that there are no particular effects on crop yields that can be ascribed to the acid species.

We do recognize the importance of stress in various cases, and we continue our studies. But, at this time, we do not report a broad acid deposition stress on agricultural crops.

Health effects. Controlled laboratory studies on animals and human subjects do indicate that acidity is one of the factors that can affect the toxicity of fine particles. The few ambient concentration measurements of acid aerosols now available fall below the range of effects demonstrated in the laboratory studies.

Most pointedly, we would note that EPA has a direct responsibility for health effect review under the Clean Air Act, and has in active review by its Clean Air Science Advisory Committee the question of health effects associated with acid aerosols.

While we study—and we'll look for their report—we note that, in our view, the proper action at this time is the first action by EPA's Science Advisory Committee in the context of their own on-going work.

All of these effects areas I've quickly touched upon, and others, will be covered in NAPAP's assessment, as I've indicated.

And I'd like to turn, based on these comments on effects, and speak for just a moment before closing about the questions in the form that you did pose them. You asked about the question of action at this time, and what pollutants and what levels and the like.

First of all, in the case of no legislative action at this time, we note that the current Clean Air Act would, of course, remain in place, but that there would be no new authorities added.

And, further, we note that legislative authority to limit the emissions from stationary sources would be intact, would strongly limit emissions from all new sources, and that the remaining question would be the need for control on existing major sources through the remainder of their lifetime until they are retired or until they are replaced by a modified facility at the same site, because, under the existing Clean Air Act, any major modification would bring the facility under the purview of the controls established by the Act.

Also, we would like to note that $SO_2$ emissions have declined by 25 percent in the period between 1973 and 1985, as was reported in our Interim Assessment summaries last year. The $SO_2$ emissions have run approximately constant since 1985. They are expected to remain approximately constant in the near term in the next 2 or 3 or 4 years.

Beyond that time, the projections about $SO_2$ emissions under current legislation vary from estimates that they will continue to remain constant to estimates that they will rise slowly, with an extreme case estimate that, after the year 2000, they might rise in total by an amount up to 30 percent in what would be called the worst case analysis.

All of the question of emission projections turns very much on what happens as to the lifetime of existing facilities and what is the role of new coal technologies that may be brought into place over that time.

You asked about what pollutants should be controlled. And we note that no choice on a set of pollutants or the relative proportions can be made on a good technical basis, anyway, until we have a clear statement of goals related to acid deposition control in what regions and/or oxidant control where we, of course, have the continuing ozone non-attainment problem.

As an example of some of the conflicts, a nitrogen oxide emission reduction strategy might actually result in increased ozone levels in some urban areas. And, so, this combined atmospheric chemistry question has to be carefully addressed.

Also, we note that certain requirements for very rapid installation of $SO_2$ retrofit controls, scrubbers on existing facilities, may, by that choice, preclude the option to install, instead, a different technology that would achieve reductions in both $SO_2$ and nitrogen oxides, and therefore achieve more benefit for acid deposition control, in the case of technologies that will become available over the next few years.

You've asked about a specific cap on emissions. And we note over-all, while a cap may be useful for administrative simplicity or a useful way to summarize the level of control sought, a simple cap is a poor surrogate for a strategy based upon actual evaluation of cause-effect mechanisms and on goals set out to achieve specific benefits or specific reduction of the stresses of acid deposition at the receptor points.

On the issue of timing, you asked a series of questions that ranged between should there be action now, or in 5 or 10 or 25 years. Our general comment is that, in the very long term, 20 to 25 years and beyond, we will see a cycling out of their normal lifetime of the existing sources which would be subject to control anyway.

So, in a sense, we would exclude the very long-term case, because all new sources will have the controls called for under the Clean Air Act anyway.

Coming to the near term, the real question seems to be between acting now and acting within a few years, 2 or 3 years or whatever suitable time might come along after further review. And here the summary comment I'd make as a closing comment is that NAPAP has no place in making a recommendation on the policy of when to act and for what purposes.

On the strictly technical issues, we would point out that, while effects are recognized now and even reasonably well surveyed, we have major uncertainties in our knowledge of those effects. We have major improvements in information and the structuring of it and the time sensitivity questions coming along.

And we believe that it would have great merit, in terms of a technical approach, to wait on the structuring of that information and to examine very carefully the question of effective and efficient strategies on a continuing basis as this develops over the next 2 years or so.

Thank you, Mr. Chairman. That concludes the statement.

Mr. SHARP. Thank you very much, Dr. Mahoney.

[The prepared statement and attachment of Mr. Mahoney follows:]

STATEMENT OF JAMES R. MAHONEY
DIRECTOR OF THE NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM
BEFORE THE SUBCOMMITTEE ON ENERGY AND POWER
COMMITTEE ON ENERGY AND COMMERCE
U.S. HOUSE OF REPRESENTATIVES

MAY 26, 1988

Thank you for your invitation to appear before the Subcommittee today, to discuss the current scientific guidance about acidic deposition (or "acid rain") that can be provided by the National Acid Precipitation Assessment Program (NAPAP).

My statement is divided into three parts, to summarize the information you have requested. First, NAPAP's statutory responsibilities and its plans for reporting its technical findings and recommendations by 1990 are briefly described. Second, the questions of "What do we know now, and what will we know by 1990?" are discussed. Finally, the questions posed in your invitation are specifically addressed, based on the preceding comments.

## NAPAP's Responsibilities and Reporting Plans

NAPAP has a statutory responsibility to develop comprehensive scientific, technological and economic information related to acidic deposition. Its scope includes: (1) the sources of the atmospheric emissions which contribute to acidic deposition (2) the atmospheric processes by which the acidic species are formed, transported and deposited, (3) the geographical areas of impact, including the definition of sensitive areas, (4) the dose-response mechanisms which describe effects of acidic deposition, (5) the extent and severity of the effects attributed to acidic deposition, (6) the time sensitivity of the forecasted effects, considering emission levels expected to occur over the years and decades ahead, (7) the costs, applicability and effectiveness of a range of available control measures, and (8) benefit valuation methods (both monetary and non-monetary) for differential analysis of various control measures.

To discharge its responsibilities, NAPAP must:

o **Be comprehensive** — giving adequate technical consideration to the entire range of effects, causes and control measures available.

o **Be credible** — to the scientific community generally, and to users of the NAPAP findings.

o **Carefully consider uncertainties** -- by reporting the scientific or engineering confidence associated with each principal finding.

o **Be neutral regarding policy choices** -- by focusing on technical findings, independent of public value debates.

NAPAP has recently announced, and begun to implement, plans to assure that these responsibilities are met in the major findings and recommendations it will report during the next two years. These plans include:

o Preparation of a detailed written plan for the 1990 Integrated Assessment, to be released for public comment during the summer of 1988. An open review meeting will be convened to receive comments, and a revised version of the plan will be completed before the end of 1988. The assessment plan will: (1) specifically define the various acidic deposition effects under consideration, (2) indicate the methods to define severity and geographic extent of effects, and (3) pose specific questions about the relative efficiency and effectiveness of alternative control measures.

o Completion of comprehensive state-of-science and state-of-technology reviews covering the several aspects of the acidic deposition issue. These reviews will survey both NAPAP and non-NAPAP developed information, will have extensive peer review, and will be critically discussed in an international technical meeting to be held in the United States in late 1989.

o Completion of the 1990 Integrated Assessment answering the questions posed in the assessment plan to be published later this year. The Integrated Assessment will provide structured information on the severity, geographic extent and time sensitivity of acidic deposition effects, and on the characteristics of a range of generic control measures. The information developed to assess control alternatives will be made available to federal agencies and other interested organizations so that comparative analyses of detailed proposals can be carried out.

o Appointment of an independent scientific oversight committee, to serve throughout the final two years of NAPAP activities. This committee will provide oversight on NAPAP's principal analyses and reports, and on NAPAP's continuing peer reviews which deal with specific technical issues.

NAPAP intends that its 1990 Integrated Assessment will provide a comprehensive view of the entire range of available technical information so that Congress, the Executive Branch and other users can develop effective policy related to acidic deposition.

### State of Knowledge: 1988 vs. 1990

A great deal of technical information about the causes and effects of acidic deposition has been developed during recent years. Some views expressed in the early 1980's have been supported by more recent studies; other views have been changed substantially. Information now available (which is summarized below) will be improved in two manners by 1990: current scientific uncertainties will be reduced, and four important new types of new information will become available. The new information will include:

o Field studies and model analyses of the **time scale of changes** in the extent and severity of effects (particularly on aquatic systems) as related to future deposition patterns;

o **Computer models** describing the complicated atmospheric chemistry and pollutant transport mechanisms which lead to acidic deposition. These models will be used to investigate source-receptor relationships, and to predict changes in deposition resulting from various emissions scenarios. Two major models, developed under the sponsorship of the Canadian, West German, and the United States Governments, will undergo field evaluation beginning this summer.

o An evaluation of the combined regional scale air pollution management issue for **both acidic species and oxidants.** Integrated air quality management strategies must be evaluated because the combined control requirements for both pollutant types can be very costly, and because some control measures may conflict with the effectiveness of other control measures.

o An evaluation of a **broad range of available and emerging control measures,** to assure that desired beneficial effects at an acceptable cost would result from any national investment in additional controls. In this regard, full evaluation of the costs, effectiveness, and potential availability of developing clean coal technologies is particularly important.

New information relevant to all four of these issues will be briefed in the NAPAP 1990 Integrated Assessment.

Current scientific views about acidic deposition were reported in detail in NAPAP's 1987 Interim Assessment. The following comments, based on the 1987 Assessment, briefly summarize our current knowledge and the major uncertainties:

o **Surface Waters** — Acidic deposition effects are generally recognized to occur in some fraction of the surface waters in geologically sensitive regions, particularly of eastern North America. Many observers consider these aquatic system impacts to be the most significant effects of acidic deposition. Surface water chemistry is influenced by many causes in addition to acidic deposition (e.g., decay of organic material, acid mine drainage, runoff of agricultural chemicals); however, acidic deposition is recognized as an important factor contributing to surface water acidity in a number of sensitive aquatic systems. Very useful regional survey information on current surface water chemistry has been developed in the past few years. Most of NAPAP's watershed research is now directed at the question of the time response of surface water chemistry to acidic deposition, to allow evaluation of projected changes in regional characteristics. Given our current understanding of the processes, and assuming constant deposition, we would anticipate no abrupt regional scale changes in surface water chemistry over the next few years. NAPAP technical reports of field and model studies on the time reponse of aquatic systems will be available beginning in 1989.

o Forests — In the relatively few cases of North American forest decline where the influence of air pollution stresses can reasonably be inferred, exposure to ozone appears to be the predominant air pollutant factor, rather than acidic sulfate or nitrate compounds. Pollution stress on high-elevation forests (i.e., those frequently exposed to clouds and mist) is receiving special study. In this case also, ozone is considered an important possible air pollutant stress agent in addition to the acidic species. Several hypotheses regarding soil mediated effects of acidic deposition on forests are being investigated. NAPAP has initiated forest response studies aimed at identifying the importance of ozone and acidic deposition stresses (for the pollutants alone and in combination with other stresses) on a range of species. The forest response program necessarily will continue for several years; the best interpretations available at the time will be included in the 1990 Integrated Assessment.

o Agricultural Crops — Research on the response of crop plants to acidic deposition indicates that there are no measurable and consistent effects on crop yield at the ambient levels of acidic deposition found in the United States. However, effects due to ozone stress have been clearly demonstrated. Research is continuing on possible combined stress effects (e.g., combinations of drought or insect pests with acidic deposition and/or ozone.) Reductions in acidic deposition for the purpose of regional crop protection would not appear to result in any beneficial effects, based on information currently available.

o Materials — Acidic deposition increases the rate of deterioration of some building materials (e.g., galvanized steel and carbonate stone), some surface coatings (e.g., carbonate paint) and cultural resources (e.g., statues). The relationships between acidic deposition rates and deterioration rates for various materials are not well quantified, and are currently being investigated. Urban areas contain most of the nation's materials and cultural resources. However, the importance of regional scale acidic deposition reductions in reducing materials damage in urban areas is not yet well known. If the majority of urban air pollution results from nearby sources, emission reductions at remote sources will not necessarily yield significant reductions in exposures in urban areas. NAPAP will report on this urban/non-urban analysis in the 1990 Integrated Assessment.

o Health Effects — Controlled laboratory studies on animals and human subjects have indicated that acidity is one of the factors that can affect the toxicity of fine particulate aerosols; however, field measurements of aerosol acidity have been very limited. The few measured concentrations available were below those observed to cause health effects in the laboratory studies. EPA has set National Ambient Air Quality Standards for $SO_2$ and $NO_x$ to protect human health. The most recent addendum to the criteria that support the Particulate Matter and Sulfur Oxides Standard was published in 1986. The Clean Air Scientific Advisory Committee (CASAC) of EPA's Science Advisory Board is evaluating newly emerging literature concerning health effects associated with acidic aerosols to address the issue of listing acid aerosol as a criteria pollutant. An Acid Aerosols Issue Paper will be reviewed by CASAC next month.

Indirect links between acidic deposition and human health are also being investigated. These include the possible leaching of toxic metals such as lead from plumbing materials by acidic water supplies, and possible mercury mobilization in acidic lakes resulting in mercury accumulation in fish. No evidence of significant health risks arising from these has been demonstrated, although a major study conducted jointly by NAPAP, the Electric Power Research Institute (EPRI), and two states on the statistical relationship between surface water chemistry and mercury in fish tissues is now underway.

o **Visibility** -- Visibility degradation results from natural causes and many pollutants, including sulfate, nitrate, and carbon-based aerosols in the atmosphere. Some of the U.S. regional visibility trends such as those in the Southeast are consistent with sulfur dioxide emission trends in the same regions, but others, such as the Northeast, are not. Reductions of sulfur emissions would generally be expected to improve visibility. However, visibility improvement could be affected by the reduction of several pollutants. Since the mix of aerosol-forming pollutants varies by region, an effective visibility control strategy would also be region specific.

NAPAP's 1990 Integrated Assessment will provide a structured analysis of all the effects discussed above (causation, severity, geographic extent, and time sensitivity) combined with analyses of the effectiveness of several categories of candidate control measures.

## Answers to Specific Questions

Based on the information summarized above, answers to the questions posed in your invitation are now summarized.

### Implications of No Legislative Action

The "no new legislation case" would leave the current Clean Air Act in place, but would add no new authorities. The 1977 Amendments to the Clean Air Act provided for stringent New Source Performance Standards (NSPS) for all major new or modified facilities, and for upgrading of the NSPS (based on periodic review of available control technology by EPA). Therefore, legislative authority to limit emissions from stationary sources over the long term (i.e., as existing facilities are retired) is already in place.

An examination of available emission trend and projection data illustrates the role of the existing Clean Air Act, and helps to define the "no new legislation case." National anthropogenic emission estimates for $SO_2$, $NO_x$, and VOC from 1900 to 1985 are shown in Figure 1. The rapid increase in emissions during the 1960's was terminated for all three pollutants, due largely to regulations adopted under the 1970 Clean Air Act Amendments. $SO_2$ emissions declined by 25 percent between 1973 and 1985 and have remained approximately constant since 1985. VOC emissions declined by 22 percent between 1970 and 1985.

A number of emissions projections have been made by federal agencies and others. Such projections are sensitive to the assumptions made about economic growth, future regulations under the Clean Air Act, the lifetime and capacity use of power plants and new technology penetration. Under current legislation, various projections for $SO_2$ emissions up to 2010 are in the range between approximately constant and a highest case estimate of approximately 30 percent increase, depending on the uncertainty factors mentioned. A long-term decline in $SO_2$ emissions, due to the retirement of existing plants, is projected to begin at a date in the range between 1995 and 2010. $NO_x$ emissions are expected to increase in the absence of new regulations and/or new technology use for motor vehicles and stationary sources. VOC emissions will probably decline due to efforts to attain the ozone standard as required by the Clean Air Act.

For the emissions projections based on current legislation, regional patterns of acidic deposition rates are expected to remain generally similar to current patterns until at least 2000. Our current knowledge, and uncertainty, about effects of acidic deposition which may have occurred during recent decades, is primarily based on field observations conducted in the past ten years. Current research on effects is aimed at assessing the cumulative impact of deposition during future years and decades. Available projections of long-term cumulative effects are very uncertain, and significant improvement in these analyses, particularly for aquatic systems, is expected by 1990.

**If action is taken, what pollutants should be controlled?**

Recommendations about the selection of pollutants to be addressed in an acidic deposition control program should be developed on the basis of specific goals established for the principal interacting regional air quality issues, including urban and non-urban ozone, and the several effects associated with acidic deposition. Different control strategies may address different patterns of possible beneficial effects, and some strategies may actually have competing effects on acidic deposition and ozone control goals. For example, a nitrogen oxide emission reduction strategy may result in increased ozone levels in some areas. In another example, requirements for rapid installation of $SO_2$ retrofit control technology at existing facilities may foreclose options for use of combined $SO_2/NO_x$ retrofit or repowering technologies expected to be commercially available in the next few years.

Even if the goals for ozone and acidic deposition control are established, the atmospheric processes involving transport, chemical transformation and deposition of sulfur, nitrogen, organic compounds and oxidants must be evaluated comprehensively, to investigate their interrelationships. This combined regional air pollution analysis is the primary goal of the Regional Atmospheric Deposition Model (RADM) which has been developed under NAPAP sponsorship. Applied studies with RADM will be underway this year, simultaneously with intensive field evaluation of the model. These applied studies will result in major improvements in analysis of regional air pollution control options.

## A specific cap on emissions?

The comments responding to the previous question are also applicable here: recommendations about the need for a specific level of emission control should be developed on the basis of specific goals for such control. Percentage reduction goals or caps may have administrative convenience, but they are poor surrogates for strategies based on evaluation of cause-effect mechanisms. Technical analysis of emission reduction requirements necessarily proceeds through the following steps:

(1) Definition of the sensitive regions and resources to be protected.

(2) Evaluation of dose-response information adequate to identify desired protection levels.

(3) Evaluation of source-receptor relationships (i.e., atmospheric modeling) to translate desired deposition limits into emission reduction plans.

Current NAPAP-sponsored research on time sensitivity in aquatic systems, forest response, and atmospheric processes models, will allow improved analyses of these issues by 1990.

## Implications of various time scales for control

The question of timing for legislative action can be cast into three categories: (1) immediate action, (2) action after limited further analysis (e.g., within two to three years), and (3) continued evaluation, without a specific schedule for action. NAPAP cannot comment on the policy questions related to these various time scales, but the question of additional technical information expected to be available by 1990 has been addressed extensively in this statement. To summarize:

o Surveys of most sensitive aquatic resources are now available, and are being improved by ongoing studies. Significantly improved information about the time response of aquatic systems to acidic deposition is expected within two years. This information will allow a much better technical evaluation of the effects of deposition in various regions.

o Information currently available is inadequate to predict effects on forests resulting from changes in acidic deposition levels. Partial results from the ongoing forest response program will be available in 1990; long-term results of the program will be available in subsequent years.

o Evaluation of materials benefits expected to result from reduced acidic deposition is highly uncertain at this time. Significantly improved evaluations for some materials are expected in 1990.

- o Information on possible direct health effects of acidic aerosols will be available from the ongoing reviews being conducted by EPA's Clean Air Scientific Advisory Committee (CASAC). Further information on indirect health effects will be available from ongoing research mentioned earlier.

- o Evaluations of the combined oxidant and acidic species regional patterns will be available by 1990, based on state-of-the-art atmospheric chemistry models.

- o NAPAP's 1990 Integrated Assessment will draw together the entire range of available technical information on acidic deposition causes and effects, and on candidate control measures. This will provide a common, well-reviewed base of technical and economic information applicable to policy evaluation.

Thank you again for the opportunity to review the technical information available to guide the development of acid rain policy. I hope the information provided will be useful to the Subcommittee.

FIGURE 1

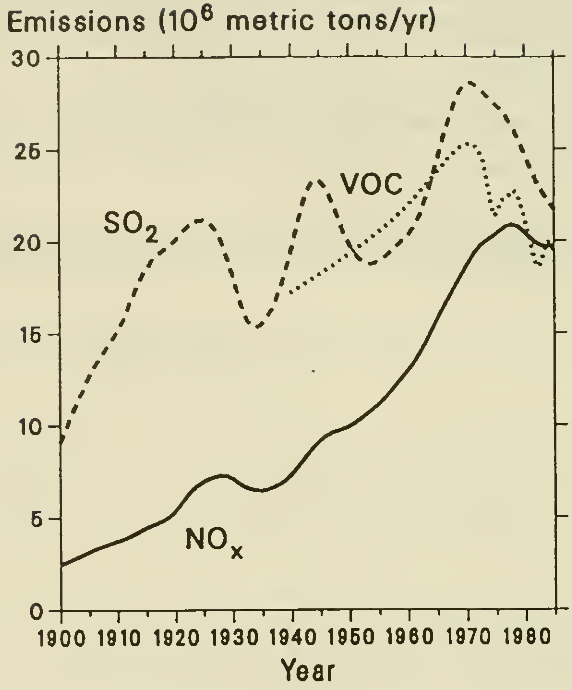

**Figure 1-6.—Generalized, interpretive view of historical trends in man-made $SO_2$, $NO_x$, and VOC emissions in the United States: 1900 to 1985.**

Note: Values for 1980 were taken from Wagner et al. (1986) for $SO_2$ and from "best estimates" for $NO_x$ and VOC (see Tables 1-13 and 1-20). For 1975 through 1984, values from Knudson (1986) for $SO_2$ and $NO_x$ were normalized to the 1980 values. For 1900 through 1975, values from Gschwandtner et al. (1985) for $SO_2$ and $NO_x$ were normalized to the normalized 1975 values from Knudson. Values for VOC, taken from the U.S. Environmental Protection Agency (1986, 1987) were normalized to the "best estimate" for 1980. (No VOC values are available for years before 1940.) Preliminary values for 1985 for $SO_2$ and $NO_x$ were obtained by adding power plant emissions, calculated using the same methodology as that used in Knudson (1986) to 1985 values for other sources from the U.S. Environmental Protection Agency (1987). (These were also included in the normalization procedure.) Finally, a curve-fitting computer program was run to produce smooth curves from the data points calculated as described above.

Mr. Sharp. Dr. Cowling, we'll be happy to hear from you now.

## STATEMENT OF ELLIS COWLING

Mr. Cowling. Mr. Chairman, I come here in two capacities, one as a member and as a representative of the National Academy of Sciences, which has produced five valuable reports on the acid deposition issue, and I am pleased to commend those reports to the members of this committee and to all of the Members of the Congress. I also come here as a scientist. I am a forest scientist, and although I won't be addressing forest issues here primarily because the questions had to do with more general issues, I do have some background in that area and have had some influence on the monitoring system that we now have in place in this country for acid deposition.

Let me say that I am disappointed that Mr. Fields has left, because he raised a question that I would very much like to have addressed in the preface of my remarks, and this has to do with whether we are talking about acid rain or air pollution, and I'd like to just read a brief statement from page 11 of my testimony which deals with this: ". . . many citizens of our country use the terms acid rain and air pollution almost interchangeably. They have come to believe that societal efforts to decrease acid rain will also result in improvement of air quality and decrease the other detrimental effects of air pollutants. There is an important measure of truth in this conviction, even though acids in rain are only a part, a small part in fact, of the total loading of chemicals transferred into ecosystems by atmospheric processes. Indeed, any societal effort to decrease acid rain will at the same time and to the approximately the same extent decrease the amount of air pollution in our country. There is no way we could deal with acid rain without having a lot of other air pollution benefits within our society."

I called attention to these five academy reports and I would like to refer especially to three of them. The first is the one which was done in 1981, which is more or less a general review and only the last chapter of that one really deals with the subject of acid deposition. But more importantly, the second and the fifth, as they are listed in the testimony I've given, contain important new insights into important issues about what we ought to do about acid deposition, and one of the very important issues is if we decreased emissions, could we expect a corresponding decrease in deposition?

George Hidy, my colleague whom you'll hear from in just a minute, was a member of the committee that undertook to study that issue and they concluded that there is no evidence for a strong non-linearity—notice the double negative—in other words—in other words it's substantially a linear issue—in the relation between long term average emissions and deposition, and it is long term average emissions and deposition with which at least aquatic ecosystems are concerned, and forest ecosystems are concerned.

The annual average concentration of sulfate in precipitation at a given site would be reduced approximately in proportion to the amount of $SO_2$ which is taken out of the emissions. They also concluded that a reduction in sulfate will get us to a reduction in hydrogen ion deposition, in other words, acid deposition.

So this report made an important contribution. The atmosphere is well mixed in a general, long term sense, is substantially linear. In a more specific sense, it is not so linear, but we can't run this country on the basis of what we can expect to do in limited portions of the country, so I think this report is of special significance.

The last report, the one called "Long Term Trends," is especially significant because it deals with what Jim Mahoney was speaking about just a moment ago. It deals with the issues of cause and effect, and an intensive and rigorous analysis is made and a number of significant insights that confirm some of the general judgments that were expressed earlier but are now better understood, as Jim indicated, because of additional new insights that we have with regard to the nature of the relationships between sulfate deposition, for example, and aquatic ecosystem effects.

I might just read a couple of these statements. "We conclude that in Eastern North America a causal relationship exists between anthropogenic sources of emission of $SO_2$ and the presence of sulfate aerosol, one of the things that affects health as well as forest and aquatic ecosystem responses, reduced visibility and wet deposition of sulfate. Another thing we conclude, that since 1970 that the southeastern United States has experienced the greatest rates of increase in parameters related to acid deposition. The Midwestern United States has experienced rates of increase somewhat lower and the Northeastern States has shown some improvement." It mentioned that we have had a decrease in emissions in the Nation as a whole, and he is quite correct, but we've had an increase in emissions in the southeastern United States and a significant increase in deposition of acids and other air pollutants in the southeastern United States—under the Clean Air Act.

Maybe that's enough to be said about the Academy reports. There is a lot more meat in them and I commend their study to all of you. Most of the middle part of the written testimony that I submitted is taken from a lecture that I was invited to give at the University of California at Berkeley some years ago and contains a personal assessment of the situation we have. I entitled the lecture, "Pollutants in the Air and Acids in the Rain: Influences on Our Natural Environment and a Challenge to Every Industrial Society." So in some sense it was easy because I had thought about these issues substantially in preparing that lecture and I call attention especially to the two big tables that are in the center of that bit of the testimony, the list of all the air pollutants of major concern to our society. There are six primary ones and two secondary ones. The two secondary ones are ozone or photochemical oxidants and acid deposition, and the six primary ones are sulfur dioxide, nitrogen oxides, toxic elements, volatile organic carbon compounds—about which we will hear more in this hearing, carbon monoxide and particulate matter. These are the six criteria pollutants and after that comes a list of the effects with which we are concerned and there are a list of eight effects: direct effects on health; indirect effects on human health; damage to engineering materials; increased haziness in the atmosphere; acidification of lakes and streams—on which Jim Galloway is an expert; fumigation of crops and forests near point sources; regional changes in the health of forests; and fertilization of crops, forests and surface waters.

Then in the righter part of that table I have listed the pollutants that are of concern with regard to each of the eight effects, and the important thing to realize is that sulfur shows up as a cause in all eight cases; nitrogen oxides shows up in seven of the eight cases; and photochemical or VOC's show up as precursor of effects in 5 of the 8 cases. Coming back to the issue of whether this should be a hearing about acid alone, it cannot be. We cannot deal with acid rain alone. We must deal with its precursors, and its precursors are of three types: sulfur oxides, nitrogen oxides and because of the complex chemistry with which all of these substances interact, volatile organic carbon compounds also are a part of the mix of pollutants with which our society is concerned for all of these eight sorts of effects.

Now during the last several years we have had an appreciable increase in our understanding. Jim mentioned this. We have a very much better and much more sound scientific basis, and on the top of page 9 of the testimony I have listed some of the major ways in which we have increased our understanding of the chemical nature of the pollutants themselves and their secondary transformation products: the meteorology and climatological processes by which they are dispersed; the mechanisms of deposition and uptake by plants and animals and microorganisms; the chemical, physical and biological mechanisms of action by which these chemicals influence one or another kind of living system; and, as Jim also mentioned, the industrial process modifications and control technologies that we can use—and there is still ongoing research in all of these areas, but nevertheless we have had a substantial increased yield of knowledge and on the bottom of page 9 and the top of page 10 there are 12 principles that are derived from a great deal of scholarship by a whole lot of people and there are certain things that are highly relevant to today's hearing, and I call attention especially to Item 7, for example: "The average zone of influence of any particular emission source extends in all directions from thee source"—the wind blows in a whole bunch of different ways in North America, in other words—"and is roughly symmetrical with the center of the deposition field"——

Mr. Sharp. That's very helpful—excuse me, Dr. Cowling, that's very helpful. That's the kind of language we are able to understand, so we're always appreciative of that.

Mr. Cowling. Well, I'm glad—but the important thing—if we've got an emissions source, it blows in all directions, the deposition field is substantially symmetrical and is displaced in its position only slightly from the primary source of emission.

That means that most pollution comes from fairly close to home, although it is also true that long distance transport is a reality.

The atmosphere is also very well mixed. That is a fairly straightforward sentence—and point 9—"For many different combinations of pollutants and specific biological effects, there is no distinct threshold dose and no safe concentration below which we are certain there will be no adverse effects." This means that any important decrease in emissions is going to lead to benefits somewhere.

That doesn't mean we can target them very easily because the atmosphere is very well mixed, as I said before—the wind blows a whole bunch of ways in North America.

Another thing: "Significant decreases in air emissions of $SO_2$, $NO_x$, CO, and probably VOC as well, are very likely to have significant and simultaneous beneficial effects on human health, visibility, materials damage, surface water quality, and both crop and forest productivity."

The last point. If a decision were reached at any time to decrease emissions of any one or all three, it is likely to take at least 10 years for there to be a significant change. Now there's a few exceptions. You could switch sources of coal, for example, and get a benefit more quickly, but in general it will take at least 5 years to develop a specific industrial State—provincial, regional, national or international or international implementation plans and it will take another 5 years to put those things into effect. So if we made a decision today, we are talking about changes probably 10 years from now.

In general, if we come to the specific questions that you asked that we address, what are the implications for human health if we take no action on acid deposition—or take no action on air pollution—that's really what we would be saying. I think it is obvious. We would continue to have damage where we now have damage, and as Jim Galloway will say in his testimony, we will have damage in some areas even though we decrease emissions somewhat because of the lag that is a part of the way ecosystems work.

This means that in areas of high emissions, we are going to continue to have high deposition, in general, and we could look at an emissions density map and see where the regions of high emissions and low emissions are.

The next question that was raised is if we chose to take action, which pollutants should be addressed? You can use this table in the testimony to ascertain that. If you decrease sulfur oxides, you'll have a series of eight benefits someplace in our society. If you decrease $NO_x$ and the provisos that have been made about decreasing $NO_x$ without also decreasing VOC—that is a very, very important issue and all of these chemicals in the atmosphere interact so we must choose wisely and in general I think it would be generally accepted that we would be better off diminishing emissions of all three than we would be choosing one alone and certainly a substantial question exists about whether $NO_x$ should be decreased alone without taking VOC with it.

Then, this very interesting question—what would be these choices? A simple cap or no emissions at all and, of course, I think all of us would agree that no emissions at all is impossible, so I've not even attempted to address that.

But a cap would mean continuing damage where we now have damage, continuing effects on health where we now have effects on health, and how much of a decrease should be achieved—and Jim Galloway has addressed that very directly and I would concur with him that if we are to undertake to protect the aquatic ecosystems in which he is a special expert person it will take a rather significant change in the amounts of emissions. That I think would be true with regard to visibility considerations, with regard to materials damage and to other influences of air pollutants in this broad sense. We are talking about three: VOC's, $SO_x$'s and of course nitrogen oxides as well.

I remind you again about the no threshold dose conclusion earlier.

You asked also about the wisdom of delay in Congressional action, and I think I would say that a decision to delay action can be justified only on political grounds. It cannot be justified on scientific grounds. We have learned enough to be able to modify the Clean Air Act in substantially beneficial ways for the guidance of the Environmental Protection Agency and the industries who will be responsive to that act. We could improve the act by adding to it provisions and understandings that derive from the substantially increased knowledge base that has been accumulating and will continue to accumulate, as Dr. Mahoney has indicated, so I think I should stop here. Thank you.

[Testimony resumes on p. 41.]

[The prepared statement of Mr. Cowling follows

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Prepared for Hearings on Our National Policy on
Acid Rain and Other Air Pollutants
by
the United States House of Representatives
Committee on Energy and Commerce
Subcommittee on Energy and Power

## Introduction:

I appear before this Subcommittee in two capacities:

-- as a representative of the National Academy of Sciences (NAS) which has produced five valuable reports on the phenomenon and effects of acid rain; and

-- as a scientist who has devoted most of the past 17 years of my life to research on the effects of acid rain and other air pollutants on forests and other ecosystems in North America and Europe.

## Principal Findings of NAS Reports on Acid Rain

As many of you know, the NAS was established by the Congress in 1863 as a private, non-profit, self-governing membership organization. The charter of the NAS identifies two primary missions: to recognize distinguished scholars in science and engineering who were dedicated to the furtherance of science and technology and their use for the general welfare; and to provide advice and council to government in matters of science and technology. The National Research Council (NRC) was established by the NAS as the principal operating arm of the Academy in fulfilling it advisory role with government.

The NAS reports on acid rain are among the most carefully prepared reports the NAS-NRC has produced during the past decade. I am pleased to commend them for very careful study by the Congress:

1) Atmosphere-Biosphere Report Interactions: Toward a Better Understanding of the Ecological Consequences of Fossil Fuel Combustion (1981);
2) Acid Deposition: Atmospheric Processes in Eastern North America (1983)
3) Acid Deposition: Processes of Lake Acidification (1984);
4) Acid Deposition: Effects of Geochemical Cycling and Biological Availability of Trace Elements (1985); and
5) Acid Deposition: Long-Term Trends (1986).

The first, second, and the fifth of these reports are most directly relevant to the purposes of these hearings.

The first NAS report provides a general overview of man-induced changes in the chemical climate of the earth and resulting threats to ecosystems caused by our abundant use of fossil fuels. The last chapter of this report deals with acid precipitation. It includes the following recommendation:

> "It is desirable to have precipitation with pH values no lower than 4.6 to 4.7 throughout areas [containing sensitive freshwater ecosystems] ... In the most seriously affected areas (average precipitation pH of 4.1 to 4.2), this would mean a reduction of 50 percent in deposited hydrogen ions. Control of $SO_2$ from new electrical generating plants alone would be insufficient to accomplish this, and thus restrictions on older plants must be considered".

The second NAS report derives from the first and deals with the very important question of whether any given change in amount of emissions of sulfur dioxide would result in an approximately linear change in amount of sulfate deposition. The principal findings of this report are as follows:

> "...we conclude that there is no evidence for a strong nonlinearity in the relationships between long-term average emissions and deposition ... the annual average concentration of sulfate in precipitation at a given site should be reduced in proportion to a reduction in $SO_2$ and sulfate transported to that site from a source or region of sources.
>
> "... a reduction in sulfate deposition will result in at least as great a reduction in the deposition of hydrogen ions
>
> "... if the molar ratio in emissions in eastern North America were changed by changing $SO_2$ emissions, a similar change would occur in the ratio of sulfate to nitrate in wet deposition".

The fifth NAS report deals with the all-important questions of cause-and-effect relationships between atmospheric deposition of sulfate and a variety of ecological and cultural-resource values in eastern North America. The principal findings of this report are as follows:

"... we conclude that in eastern North America a causal relationship exists between anthropogenic sources of emissions of $SO_2$ and the presence of sulfate aerosol, reduced visibility, and wet deposition of sulfate.

"... there is a cause-and-effect relationship between $SO_2$ emissions and stream sulfate fluxes".

"... we conclude that acid precursors, particularly $SO_2$, have been emitted in substantial quantities in the atmosphere over eastern North America since the early 1900s".

"... since about 1970, we conclude that the southeastern United States has experienced the greatest rates of increase in parameters related to acid deposition. The midwestern United States has experienced rates of increase somewhat lower than the Southeast. In the northeastern United States the trend has been one of modest decreases".

"The ratio of output to input [in stream sulfate fluxes] decreases with increasing distance from major source regions, suggesting that dry deposition is an important contributor to sulfate flux inputs, especially near major source regions".

"... in the judgment of the Committee, the weight of evidence indicates that atmospheric deposition of sulfate has caused some lakes in the Adirondack Mountains to decrease in alkalinity".

"... fish populations decline concurrently with acidification ... These data demonstrate declines in acid-sensitive fish species populations over the past 20 to 40 years in lakes thought to have been acidified over the same time period".

"Geographically widespread reductions in tree ring width and increased mortality of red spruce in high elevation forests of the eastern United States began in the early 1960s and have continued to the present. The changes occurred about the same time as important climatic anomalies and in areas subject to comparatively high rates of acid deposition. The roles of competition, climatic and biotic stresses, and acid deposition and other pollutants can not be adequately evaluated with currently available data".

## Principal Findings from My Own Scientific Assessment

Some months ago I was asked to present the 25th Albright Conservation Lecture at the University of California at Berkeley. I gave it the title: "Pollutants in the Air and Acids in the Rain: Influences on Our Natural Environment and a Challenge for Every Industrial Society". Since it contains the essence of my assessment of the scientific facts and the challenges they present to our society I offer the following excerpts as a part of my testimony:

### POLLUTANTS IN THE AIR AND ACIDS IN THE RAIN

> The airborne chemicals of major concern to our society are listed in Table 1. They include two major types of pollutants (primary and secondary) and eight specific chemical or physical groups of substances ... These airborne substances and their reaction products are carried by wind and clouds wherever the wind blows and then deposited on the surfaces of vegetation, soils, surface waters, and engineering or cultural materials at short or long distances from the original sources of emission. Thus, the chemical composition of the air, and the rain, snow, dew, hail, fog, and cloud water within any region is a function of all the airborne substances dispersed, mixed, transformed, and transported into the atmosphere of that region and then deposited and taken up by the plants, animals, and microorganisms in terrestrial and aquatic ecosystems.

### THE INFLUENCES OF AIR POLLUTANTS ON OUR NATURAL ENVIRONMENT

> As indicated in Table 3, airborne chemicals cause eight different kinds of detrimental or beneficial effects on our society:
>
> -- direct effects on human health;
> -- indirect effects on human health;
> -- damage to materials;
> -- increased haze in the atmosphere;
> -- acidification of lakes, streams, ground waters, and soils;
> -- fumigation of crops and forests near point sources;

## Table 1. Air Pollutants of Major Concern to Society

1) Sulfur dioxide (SO2)--A colorless gas produced during combustion of sulfur-containing materials such as coal, oil, and biomass, and during smelting of sulfide metal ores. SO2 is emitted mainly by large stationary sources such as fossil fueled power plants, metal smelters, and certain other industrial and commercial installations. Biomass burning is an important source of sulfur oxides in tropical regions of the world.

2) Nitrogen oxides (NOx)--Two colorless gases (NO and NO2) produced in any high temperature process such as combustion of coal, oil, gasoline, and natural gas. NOx's are emitted by both stationary sources and transportation vehicles. In tropical countries burning of biomass is also an important source of NOx.

3) Toxic elements--Heavy metals such as lead, cadmium, nickel, and mercury or fluorine and other toxic elements are released mainly by large metal smelters and by transportation vehicles using leaded gasoline.

4) Volatile organic compounds (VOC)--A wide variety of carbon compounds ranging from such simple molecules as ethylene, gasoline, and cleaning and painting solvents to very complex molecules such as pesticides. VOC are emitted by many different, usually small stationary and mobile sources.

5) Carbon monoxide (CO)--A colorless and odorless but highly toxic gas produced during incomplete combustion of coal, oil, and natural gas and incineration of garbage and other solid and liquid wastes. Carbon monoxide inhibits respiration in humans and other animals. It is of concern to society mostly in urban areas where it accumulates in stagnant air mainly from transportation vehicles.

6) Particulate matter (PM)--A catch-all category of pollutants ranging from very coarse "fugitive dust" particles that cause soiling of textiles, windows, paints, etc., to very fine aerosol particles that cause atmospheric haze or are drawn into lungs where they induce respiratory disease. These substances are extremely diverse both chemically and physically. The larger particles range from almost pure carbon in the case of soot from oil burners to mineral dusts in the case of manufacturing facilities that process cement, asbestos, clay, ceramic, glass, textile, and other materials. The fine particles range from smoke to all sorts of sulfate, ammonium, organic, metallic, and other particles formed by condensation of gases, vapors, and other volatile substances in the atmosphere. Some of these particles have very remarkable and complex fine structures that are characteristic of the original sources of the emissions.

7) Ozone (O3) and other photochemical oxidants--These substances include peroxyacetyl nitrate (PAN) and peroxyprprionyl nitrate (PPN). They occur only as secondary pollutants which are produced when NOx and VOC interact with atmospheric oxygen in the presence of sunlight. Ozone is the most important of these three pollutants because it is much more abundant even though it is somewhat less toxic than PAN or PPN. These compounds are among the most toxic gases to which plants, animals, and humans are exposed in the environment.

8) Acid deposition--A variety of acidic and acidifying substances produced when gaseous SO2, NOx, HCl, and certain other airborne chemicals interact with oxygen, ammonia, and moisture in the air to give aqueous solutions or aerosols of sulfuric, nitric, and hydrochloric acids. Wet deposition of these substances occurs during all rain, snow, hail, dew, fog, cloud, or rime-ice events; dry deposition occurs at all times--by absorption or adsorption of gaseous SO2, NOx, HNO3, and HCl and by impaction of sulfate, nitrate, and chloride aerosols on the surfaces of plants, soils, animals, microorganisms, surface waters, and materials. The acidic and acidifying substances in wet and dry deposition may be partially or completely neutralized by alkaline earth elements such as calcium, potassium, sodium, or ammonium ions. Acidification of ecosystems also occurs when ammonium sulfate aerosol and certain other ammonium compounds or ammonia itself are taken up by plants, animals, or microorganisms after deposition into ecosystems.

Table 3. Major Effects of Air Pollutants on Society

| Type of Effect | Nature of Effect | Pollutants Involved |
|---|---|---|
| 1) Effects on human health due to inhalation of airborne chemicals | Pulmonary dysfunction, respiratory disease, and mental retardation (especially in children) | Ozone<br>Sulfur dioxide<br>Nitrogen oxides<br>Particulate matter<br>Carbon monoxide<br>Toxic elements |
| 2) Effects on human health due to atmospheric deposition or leaching and later ingestion of airborne or soilborne chemicals via drinking water, fish, or other food products | Diarrhea and mental retardation in children and poisoning of adults by lead, mercury, copper, cadmium, or other toxic elements | Toxic elements<br>Acid deposition resulting from sulfur and nitrogen oxide emissions |
| 3) Damage to engineering materials, statuary, monuments, and other cultural resources | Increased corrosion of metals; accelerated weathering of stone and masonry; soiling of textiles, glass, paints, and other materials; deterioration of paints, plastics, and rubber | Sulfur dioxide<br>Nitrogen oxides<br>Particulate matter<br>Ozone<br>Acid deposition |
| 4) Increased haze in the atmosphere | Decreased visibility in urban and rural areas with attendant decreases in safety of air transport and enjoyment of scenic vistas from aircraft and in parks | Particulate matter<br>Sulfur dioxide<br>Nitrogen oxides<br>Volatile organic compounds<br>Photochemical oxidants |
| 5) Acidification of lakes, streams, ground waters, and soils | Death and reproductive failure in fresh-water fish, decreased fertility of soils | Sulfur dioxide<br>Nitrogen oxides<br>Acid deposition |
| 6) Fumigation of crops and forests near point sources of pollutants | Decreased growth and yield of crops and forests | Ozone<br>Sulfur dioxide<br>Nitrogen oxides<br>Toxic elements |
| 7) Regional changes in the health and productivity of forests | Decreased growth, increased mortality, and predisposition of forest trees to biotic and abiotic stress factors | Ozone<br>Nitrogen oxides (?)[1]<br>Ammonia and ammonium nitrogen (?)[1]<br>Sulfur dioxide (?)[1]<br>Acid deposition (?)[1]<br>Toxic elements (?)[1] |
| 8) Fertilization of crops, forests, and surface waters | Increased productivity of crops, forests, and surface waters | Nitrogen oxides<br>Ammonia and ammonium nitrogen<br>Sulfur dioxide<br>Acid deposition<br>Particulate matter |

[1] Question marks indicate major continuing uncertainty about the role of specific pollutants other than ozone even though the involvement of air pollutants generally is widely assumed.

-- regional changes in health and productivity of forests; and
-- fertilization of crops, forests, and surface waters.

In examining the information in Table 3, please note that:

1) Sulfur dioxide (SO2) emissions are involved in all eight effects;

2) Nitrogen oxides (NO and NO2) or their photochemical derivatives are involved in seven of the eight effects;

3) Volatile organic compounds (VOC) or their photochemical derivatives such as ozone (O3) are involved in five of the eight effects;

4) All three of these primary pollutants (SO2, NOx, and VOC) are produced during combustion of fossil fuels in power plants, metal smelters, transportation vehicles, and other industrial, commercial and domestic uses of energy; and

5) SO2, NOx, and VOC are also the most important chemical precursors of photochemical oxidants, acid deposition, atmospheric haze, and certain types of particulate matter which have a wide range of detrimental effects on our society. For this reason, these three primary pollutants are major keys to the proper management of air quality in most industrial regions of the world (NAS, 1983, 1984, 1986).

The challenge for industrial and political leaders in North America and in Europe continues as always -- to make decisions about complex issues under conditions of substantial uncertainty. The uncertainties involved in management of air pollution and acid deposition are analogous with those that surrounded the debates about the role of phosphorous in the eutrophication of Lake Ontario and Lake Erie in the early 1970's. The experts then could not agree. Some said a 40% decrease in phosphorus loading would be needed. Others said 75%. Still others said nitrogen was to blame, not phosphorus. Environmentalists warned of "possible irreversible harm". Industry said more research was needed. Finally, a political decision was reached -- a plan should be developed. More debates were held. A theoretical model was used to predict that a 50% decrease in phosphorus loading might be sufficient. A management plan was finally implemented under conditions of continuing uncertainty. After some time the lakes began to improve. The theoretical estimate proved to be too low, but with some further adjustments the plan worked and the lakes are now on the road to recovery (NAS-RSC, 1985).

The information summarized in Tables 1 and 3 show that there is a substantial base of scientific knowledge about the specific airborne chemicals involved in each of the eight major effects of air pollutants on our society...

## THE SCIENTIFIC FOUNDATION FOR PUBLIC AND PRIVATE DECISION MAKING

During the past 25 years, scientific understanding about airborne chemicals and their effects on our natural environment has increased enormously. At present we know a great deal about:

-- the chemical nature of primary air pollutants and their transformation products;
-- the meteorological and climatological processes by which they are dispersed;
-- the mechanisms by which pollutants are deposited from the atmosphere and taken up by plants, animals, and microorganisms;
-- the chemical, physical, and biological mechanisms of action on human health, materials, atmospheric haze, agricultural crops, aquatic ecosystems, and certain types of forest trees; and
-- the industrial process modifications and control technologies by which emissions of air pollutants can be managed within limits accepted by society through review of industrial standards of performance and government regulations.

In the numbered paragraphs that follow, I have listed 12 principles regarding air pollution and its control. These principles were developed in an attempt to summarize some important features of our present knowledge about air pollution and its control. They have been carefully reviewed by both atmospheric scientists and biologists, by colleagues in industry, and by officials in federal and state regulatory organizations. These principles provide a part of the foundation for further public and scientific discussions about the phenomena, effects, and management of air quality in industrial societies:

1) Combustion of fossil fuels is the single most important general source of air pollutants (NAS, 1981, 1986).
2) The concentration and deposition of primary air pollutants decreases progressively with increasing distance and time after emission from any particular emission source (Altshuller and Linthurst, 1983).
3) The concentration and deposition of secondary pollutants is a complex function of meteorological, seasonal, altitudinal, temporal, geographical, and other factors (NAS, 1983).
4) The elapsed time between emission and deposition varies with the pollutant in question but ordinarily ranges from a few minutes or hours to a maximum of 4 or 5 days (NAS, 1983).
5) This time is sufficient for dispersal over both short distances (0-500 Km) and long distances (> 500 Km) (NAS, 1983, 1986).
6) No state or nation can control the quality of air within its own borders without cooperation by other nearby states or nations (NAS, 1983, 1986).
7) The average zone of influence of any particular emission source extends in all directions from the source, and is roughly symmetrical with the center of the deposition field generally displaced from the source by a distance of only a few tens or perhaps hundreds of Km. Thus, air pollutants generally have their greatest effects within a few hundred Km from their source of the emission (Bolin et al, 1972; NAS, 1983, 1986).
8) The atmosphere over most industrial regions (especially in Europe and North America) is very well mixed; also the distance between most sources of air pollution is much smaller than the average distance of dispersal from any given source. Thus,

pollutants rarely, if ever, occur alone; in addition, they frequently react with each other leading to new chemical transformation products. They also can interact so as to produce combined effects which are additive, synergistic, or antagonistic (NAS, 1981, 1986; Ministry of Agriculture, 1982).

9) For many different combinations of air pollutants and specific biological effects, there is no distinct "threshold dose" or "safe concentration" below which we are certain there will be no adverse effects; thus, any important decrease in emissions is very likely to result in decreased adverse effects (NAS, 1981; Ministry of Agriculture, 1982).

10) If emissions of primary pollutants are decreased (or increased) by a significant amount in an area of several hundred square Km, the resulting average decrease in air concentrations and/or deposition of pollutants will be roughly proportional to the magnitude of change in emissions (NAS, 1983).

11) Significant decreases in air emissions of SO2, NOx, CO, and probably VOC as well, are very likely to have significant and simultaneous beneficial effects on human health, visibility, materials damage, surface water quality, and both crop and forest productivity (OTA, 1984; Ministry of Agriculture, 1982; NAS, 1986).

12) If a decision were reached to further decrease air emissions of SO2, NOx, and VOC, it is very likely to take

-- at least 5 years to develop specific industrial, state, provincial, regional, national, or international implementation plans; and

-- at least another 5 years to design, build, and install the pollution-control machinery and management systems that will be necessary to achieve the decrease in emissions that is planned (OTA, 1984).

For all of the above reasons, it seems prudent that the United States and Canada, and various countries in Europe, earnestly continue their historical air-quality planning and evaluation procedures. In doing so, leaders of industry and government should recognize that:

1) Research is continuing and will continue to increase scientific and public understanding of air pollution and its direct and indirect effects on our society;

2) An integrated (multiple pollutant and regional) program for management of air-quality would have many advantages over the present single-pollutant and state-by-state and province-by-province methods of implementation;

3) Cooperation, consultation, and statesmanship is likely to produce more economically and scientifically sound management plans than legislatively mandated solutions; and

4) It is likely to take at least 10 years to implement a decision to make a significant change in the air quality in any large part of the United States and Canada. (Underlining added for emphasis in these hearings).

## General Comments and Conclusions:

In his request to participate in these Hearings, Chairman Phillip Sharp asked that I address four principal issues:

1) What are the implications for human health and the environment of taking no action on acid rain?

In answering this question it is important to recognize that many citizens of our country now use the terms "acid rain" and "air pollution" almost interchangeably. They have come to believe that societal efforts to decrease "acid rain" will also result in a general improvement of air quality and decrease the other detrimental effects of air pollutants. There is an important measure of truth in this conviction even though acids in rain are only a small part of the total loading of chemicals transferred into ecosystems by atmospheric processes. Indeed, any societal effort to decrease "acid rain" will, at the same time, and to approximately the same extent, decrease the amount of air pollution in our society.

If no further action is taken on "acid rain" (or air pollution) the pollution climate over North America will continue to change more or less as it has during the years since the last revision of the Clean Air Act in 1977. That is, the emissions (and concentration and deposition) of air pollutants will continue to change in response to regional shifts in the nature and productivity of our major fossil-fuel powered industries and in terms of decisions by the managers of those industries and the regulatory agencies of the states. This means that:
-- emissions will probably remain high in regions of high emissions density (such as in the Los Angeles basin, and in states with high current emissions of $SO_2$, NOx, and VOC such as:
Ohio, Pennsylvania, Indiana, Illinois, Missouri, Texas, Kentucky, Tennessee, Florida, West Virginia, Michigan, New York, and Arizona with respect to $SO_2$ emissions, and
Texas, California, Ohio, Pennsylvania, Illinois, Louisiana, Indiana, New York, and Michigan with respect to NOx;
-- emissions will probably remain low in regions of low emissions density such as the inter-mountain west and the Great Plains states;
-- emissions will probably increase in regions of increasing industrial development such as the southeastern states.

In other words, if no action is taken on "acid rain", the implications for human health and environment are that the several different effects of airborne pollutant chemicals (see list of the Major Effects of Air Pollutants in Table 3) may be expected to continue to change according to the extent of changes of emissions of primary pollutants and the concentrations and deposition of airborne pollutant chemicals (see list of major air pollutants in Table 1) in the various regions of our country. That is, the detrimental effects of air pollution on human health and environment will continue in areas of high emissions and deposition, will remain about the same in areas of unchanging emissions and deposition, will increase in areas of increasing emissions and deposition, and will decrease in areas of decreasing emissions and deposition. These general expectations will hold true with respect to all eight of the effects listed in Table 3.

2) If we choose to take action, which pollutants should be addressed? Sulfur dioxide only? What about nitrogen oxides and volatile organic compounds?

The answer to this question depends entirely on the nature and geographic distribution of the effects our society chooses to avoid or chooses to accept. Please refer to the column in Table 3 dealing with "pollutants involved" with regard to each major effects of air pollutants on society.

Decreases in emissions of $SO_2$ would be helpful if our society wishes to avoid all eight major effects listed in Table 3 including:
-- direct health effects,
-- indirect health effects,
-- damage to engineering materials,
-- visibility losses,
-- acidification of lakes and streams,
-- fumigation of crops and forests in the vicinity of major point sources,
-- possible regional changes in the health and productivity of forests, and
-- fertilization of crops, forests and surface waters.

Decreases in emissions of NOx would be helpful if our society wishes to avoid or decrease six of the eight major effects listed in Table 3 including:
-- direct health effects,
-- indirect health effects,
-- damage to engineering materials,
-- acidification of lakes and streams,
-- possible regional changes in the health and productivity of forests, and
-- fertilization effects on crops, forests, and surface waters.

Decreases in emissions of volatile organic compounds (VOC) and nitrogen oxides (NOx) would be helpful if our society chooses to avoid or decrease exposure to ozone and other photochemical oxidants in the atmosphere. This would lead to avoidance or decreased=s in five of the eight effects listed in Table 3 including:
-- direct effects on human health,
-- damage to engineering materials, especially deterioration of paints, plastics, and rubber products,
-- losses in visibility,
-- fumigation of crops and forests near point sources, and
-- regional changes in the health of forests,

3) What are the implications for human health and the environment of alternative levels of pollution control? What are the implications of a simple cap on emissions? Of completely eliminating man-made pollution? Of any level or reduction in between?

The implications for a simple cap on emissions in any given region of the United States are that effects now observed would continue. That is, where ever health or environmental effects are now observed, such effects will continue to be observed. In the case of health, a cap on emissions of $SO_2$ and NOx will mean that both direct and indirect health effects will continue about as they have in the past. In the case of visibility degradation, a cap on $SO_2$ emissions would probably mean some general improvement in regional haziness of the atmosphere. In the cases of acidification of lakes and streams, a simple cap on $SO_2$ emissions would probably mean continuing gradual acidification of surface and ground waters in regions in which acid neutralizing capacity becomes exhausted by continuing sulfate deposition. About the same would be true for a cap in NOx emissions, although the effect would be more pronounced on release episode rather than on a gradual change in surface water acidity.

Completely eliminating all man-made emissions of any one or all three major primary pollutants -- $SO_2$, NOx, and VOC -- would be possible technically but would involve so major dislocations in the industrial development and life style of the American people that it is inconceivable both economically and politically.

Something in-between a simple cap and completely eliminating man-made pollution is attainable technically and would obviously be more feasible both economically and politically. A number of nations in Europe as well as Japan in Asia and Canada in North America have pledged themselves to a 30 percent decrease in $SO_2$ emissions in about a decade. I understand that decreases between 25% and 75% in $SO_2$ and NOx emissions can be attained in the utility sector but would be much more difficult to attain in the case of mobile sources.

I also understand that much more substantial uncertainties exist about the benefits of decreasing any one of the three primary pollutants ($SO_2$, NOx, and VOC) than about the benefits of decreasing all three simultaneously and in approximately equal relative amounts. As indicated in Principal 11, "significant decreases in air emissions of SO2, NOx, CO, and probably VOC as well, are very likely to have significant and simultaneous beneficial effects on human health, visibility, materials damage, surface water quality, and both crop and forest productivity (OTA, 1984; Ministry of Agriculture, 1982; NAS, 1986)".

4) What are the implications for human health and the environment of alternative deadlines for achieving pollution reduction? What happens if Congress legislates requirements that take effect tomorrow? If Congress waits five years? Ten Years? 15 years? 25 years?

In response to question: "What happens if Congress legislates requirements that take effect tomorrow?", I can only repeat the several statements at the end of the Albright Conservation Lecture:

> "... it seems prudent that the United States and Canada, and various countries in Europe, earnestly continue their historical air-quality planning and evaluation procedures. In doing so, leaders of industry and government should recognize that:

1) Research is continuing and will continue to increase scientific and public understanding of air pollution and its direct and indirect effects on our society;

2) An integrated (multiple pollutant and regional) program for management of air-quality would have many advantages over the present single-pollutant and state-by-state and province-by-province methods of implementation;

3) Cooperation, consultation, and statesmanship is likely to produce more economically and scientifically sound management plans than legislatively mandated solutions; and

4) It is likely to take at least 10 years to implement a decision to make a significant change in the air quality in any large part of the United States and Canada.

The reasons for the last of these four conclusions is that it is likely to take at least 10 years to implement a decision to make a significant change in the air quality in any large part of the United States and Canada. If a decision were reached to further decrease air emissions of SO2, NOx, and VOC, it is very likely to take

-- at least 5 years to develop specific industrial, state, provincial, regional, national, or international implementation plans; and

-- at least another 5 years to design, build, and install the pollution-control machinery and management systems that will be necessary to achieve the decrease in emissions that is planned (OTA, 1984)".

Delaying a Congressional decision to amend the Clean Air Act by five years, 10 years, 15 years, or 25 years can be justified only on political grounds. It can not be justified on the basis of scientific implications for human health and environment. A huge addition reservoir of valuable information about the emissions, transformations, dispersal, deposition, and uptake of airborne pollutant chemicals, and the effects of these compounds on public health and environment, is available now than was available in 1977 when the Clean Air Act was last amended. Although much remains to be learned about may aspects of the atmospheric sciences and biological sciences involved, the yield of new scientific information is more than sufficient to achieve a significant improvement in many scientific and technical features of the Clean Air Act at this time.

Mr. SHARP. Thank you very much, Dr. Cowling.

We have a quorum call on the House floor that is to be followed immediately by a vote, and so I think this is probably a good place for us to take what may be about a 15 minute recess, and so I'll ask our witnesses and the audience to bear with us and we'll go vote and come back and then we'll hear from Dr. Hidy.

The subcommittee stands in recess.

[Brief recess.]

Mr. SYNAR [presiding]. Let's start getting everyone back. Mr. Hidy, I think we're with you, now, and we welcome your comments.

## STATEMENT OF GEORGE HIDY

Mr. HIDY. Thank you, Mr. Chairman. It's a pleasure to be with you today.

I represent the Electric Power Research Institute, and want to thank you for your invitation to join you to talk about acid rain. For those of you who do not know about the Electric Power Research Institute, just let me spend a minute or two and describe what it is.

Basically, the Institute is a planning and management body that manages approximately $300 million a year in research for the electric utilities industry, namely, the members of EPRI, which include, roughly, two-thirds of the industry at large in this country.

Of that $300 million, roughly $30 million a year, or 10 percent, goes toward environmental assessment research, for which I am responsible. Approximately another $100 million a year is spent on emission control technology or on clean coal technology alternatives.

Over the last 10 years EPRI has contributed to the national acid deposition research assessment program, in one form or another, with an investment of about $80 million in research, and, in the emission control area, approximately $1 billion of investment on behalf of the utilities industry and the public.

I'd like, for brevity's sake, to go right to the four questions that you invited us to discuss with you, and deal with each of those in turn.

I'd like to note that in this context the research that has gone on since the middle 1960's in addressing issues of the Clean Air Act certainly embrace the acid deposition research as it has been done in the last few years.

So, again, I would support Dr. Cowling's viewpoint that we're dealing in an over-all context with air quality and air pollution improvement in general, acid rain being only one aspect of that issue.

Acid rain, of course, as you're well aware, is focused primarily on regional questions of the effects of acidity coming from the atmosphere on terrestrial and aquatic ecosystems.

With respect to your questions, then, let me try to briefly give answers to each one of these, at least from our perspective and our research experience.

The first question regards the implications of the current risk to the environment for taking no action. Basically, in addressing that, we feel from our experience in that, shown by the Interim Assessment, that the effects are generally quite elusive still and quite uncertain in their severity and extent.

The evidence to date would indicate there are no catastrophes imminent in the environment nor in the health area, and the effects are largely confined to certain specific areas of concern, primarily in the eastern United States and, in part, in susceptible areas of the Alpine areas of the west.

Just to summarize in each of the areas, I won't repeat what Dr. Mahoney and Dr. Cowling have said, but, from our perspective at the regional levels of air pollution either in the air or at deposition levels, our experience is that we do not see any health effects that can be attributed to either sulfur or nitrogen oxides at those very low levels in the atmosphere, which are far lower than the national ambient air quality standards.

With respect to aquatic effects, there is no doubt that there are sensitive natural waters, both lakes and streams, across the United States. However, if one applies rigorous scientific standards to the assessment of recent acidity developing in those lakes, we find that historic information can only identify, out of the large number of waters surveyed, a very few that have a recent acidity that can be explained only by acid deposition.

With respect to terrestrial effects, the information that we have gained from our work and those of others indicates that agricultural crops experience very little, if any, damage at all.

With respect to the forests, again our experience suggests that the die-back of forests in the United States is concentrated in parts of the east and deals primarily with red spruce. The die-back is the apparent result of many stress factors, only one of which is acid deposition, and another of which is ozone exposure.

With respect to material damage, it's clear and has been clear for many years, even at the time of the inception of the Clean Air Act, that corrosion and damage to paints and other materials in the urban environment locally has been an effect of air pollution, but it's certainly not unique to a label of acid deposition.

With respect to visibility, sulfate in the atmosphere is certainly a factor in contributing to visibility impairment, both in the east and the west. However, our recent findings and those of other scientists would indicate that sulfate is only part of the issue.

A major part of the aerosol which is responsible for visibility in the air also contains organic material which comes from quite different sources. And we have to be aware, also, that weather in itself is a factor for low visibility. Weather, including changes in temperature and humidity.

It's important to note in this particular question, too, as noted by others on this panel, that the Clean Air Act itself has contributed to reducing emissions and, thus, at the present stage of our world of air pollution control, we've certainly reduced the severity of impact and the extent of impact by reduction of both sulfur and nitrogen oxide emissions throughout the United States.

With respect to your second question, what pollutants should be addressed if one wants to deal with the acidity problem relating to the atmosphere, certainly both sulfur oxides and nitrogen oxides need to be examined for control.

It's already been pointed out, I think, that the volatile organic carbon component of air pollution involves the production of oxidants in the atmosphere, namely, ozone and hydrogen peroxide.

If we want to deal with the ozone problem, under the terms of the non-attainment questions or the change in national ambient air quality standard with the Clean Air Act, one has to use great care in treating nitrogen oxides for reduction separate from the volatile organic question, because, as has already been pointed out, atmospheric chemistry tells us that it's possible under some circumstances to actually increase oxidants by decreasing nitrogen oxides for certain levels of volatile hydrocarbons.

With respect to Question 3, you've asked about alternate levels of pollutant control and what are the implications in terms of reducing risk of environmental impact from acid deposition.

I would say, certainly, the ideal of zero discharge from industry in this country or throughout the world is impractical. It's not cost-effective to consider such an option, so I think that that is not within, at least, the practical bounds of what can be done in this country, should anything be done.

In that sense, the cost-effectiveness of acid deposition legislation really has to be very carefully examined, I think, because of the character of the risk involved and elusiveness of the effects, even with the science we have today. The benefits from very expensive emission controls are very difficult to pin down for the potential damage that one can identify.

And, so, one is really at a loss, and probably will be at a loss for many, many years to come, with actually pinning down in any quantitative way the benefits to be gained by attacking acid deposition alone.

The second point, in terms of developing alternate levels of pollution control, relate to prudency. If one can't establish cost benefits, let's say, or establish quantitatively a risk reduction framework, one is faced with legislation which amounts, basically, to an insurance policy in the hope that we will indeed reduce environmental risk in the future. And, certainly, one can hardly argue with that kind of philosophy.

Dr. Cowling has mentioned the threshold question, and the threshold question is imbedded in your question about alternate levels. He has noted that research to date has not come up with well-defined thresholds either for sulfur or nitrogen deposition versus an adverse risk.

So, science, again, does not help to any appreciable extent in providing some receptor basis for establishing alternate levels of emission control.

The next area of concern, I think, in developing legislation is the matter of priorities. We deal in this country on a piecemeal basis with environmental risk. We do not deal in a proper way with the entire environmental risk framework that we know exists in this country today.

So, in this sense, I think, it's very useful for Congress to think of priorities in this case, as we have to think about priorities in all areas, and think carefully, both historically and at the present time in the framework we live in, of whether acid deposition effects per se are significant enough in their total risk to society to warrant a priority for spending money for emission control over a number of other stresses that exist on the environment.

The last area of concern, I think, is the economic issue, which, Mr. Chairman, you pointed out is of concern. I think it's useful to also consider economics not in a national sense at this time, but point out to this committee—again, I'm sure you're well aware of it—that the United States now lives in a worldwide marketplace.

We can no longer think of things that we need to do for society and for our country in a vacuum in terms of what our economic future will be.

I'd like to read you a quote for the record, in this sense, to call your attention to the economic question. This comes from an 1986 statement of the National Research Council, Committee on Electricity in Economic Growth. This quote states: "To foster increased productivity, policy should seek to lower the real cost of electricity supply by removing any regulatory impediments and developing promising technologies to provide electricity."

And I think this ought to be in your thinking for priorities for this issue, as well as many others, that face our industry today in the worldwide marketplace.

With regard to emission caps, I agree very much with what Dr. Mahoney has said, that these represent a simplistic approach to emission controls. I think there are better ways to go about doing it, including taking account of geographic factors.

But, most important of all, I think, the caps should be couched in the timing that is necessary to implement new emission control technology in the context of clean coal technology or other new technologies that will permit us to increase the efficiency of our industry and not to revert to end-of-pipe technology on aging or antique emission sources.

This doesn't really address your question of alternate levels, but I would say that your decision on alternate levels has to be really a political one, because science does not tell us very much about the levels for protection that would be helpful to you.

The progress concept, then, is probably most useful over a time scale that will permit new technology to be put in place, should you decide emission controls are required.

This brings me to your Question 4 on the matter of timing. Again, our experience is that the science that we have, even though we've made great progress in this area, really can't tell us very much about the rate of change in natural systems that you're so concerned about.

All we can say is that our best indications are that change in the systems in questions have generally been slow in response to multiple stresses that exist that are hard to separate.

The slowness gives us a chance, however, to take into account not only the timing to progressively put new emission control systems into place, if you feel that's necessary, but also, in agreement with Dr. Mahoney, to take time out for the 1990 assessment to complete its work so that we maximize the information, both technological and scientific, to make decisions on this issue and ensure that the reliability of those decisions is maximized.

I'd like to mention one other thing, in addition to your question on timing, which is this matter of geographical sensitivity. It's well known in atmospheric research that there is a rule of thumb that the farther away you are from a source, no matter which way the wind blows, Mr. Chairman, the effect is less.

Therefore, this distance factor really should be a part of your thinking in terms of any emission control strategy that you might consider. There are models available, and there have been many, many exercises of mathematical models to provide scenarios to optimize an emission control program throughout the country.

Unfortunately, the wisdom that has come from these kinds of calculations has not reached the legislative agenda as yet. Part of the reason for that is that the reliability of these models has been questioned and criticized.

The reliability depends to a very great extent on testing the models against observations of what goes on in the atmosphere. Those tests have been done to a limited extent on historical data.

However, there is a major new program under NAPAP, in cooperation with the Canadian Government and EPRI, which will provide such a data set before the 1990 frame.

We believe that the reliability of both the new and the old models will be well tested with this data set, leading to the opportunity to consider geographically specific legislation which, in our minds, will no doubt be much more economically sound than simple national uniform roll-back programs.

In summary, then, just let me mention that we believe, again, that the effects of acid deposition at the current deposition levels, even in the eastern United States, are indeed elusive and uncertain.

The changes are slow. As far as we can tell, they are slow enough to take a considered and careful approach to the kind of emission controls that are necessary, if they are necessary.

As part of this careful consideration, we believe that cost and benefit analysis is essential with any change in the Clean Air Act policy, because the costs are so very high to change the emission patterns in the United States, and this is certainly recognized, I believe, by the committee.

Again, I urge you to consider very carefully legislation at this time, as opposed to waiting for the NAPAP assessment to be complete, and to take advantage of the NAPAP assessment and the public investment made in that exercise to make your decisions in the 1990 framework.

I think we have that time before us without the catastrophes that may have been talked about in the early 1970's in this area.

Thank you.

Mr. SHARP. Thank you very much, Dr. Hidy.

[The prepared statement and attachment of Mr. Hidy follows:]

## STATEMENT OF DR. GEORGE HIDY

Ladies and Gentlemen:

My name is Dr. George Hidy, Vice President of the Environment Division of the Electric Power Research Institute (EPRI). EPRI plans and manages a program of more than $300 million, of which approximately $30 million is devoted to environmental science research annually. Since the mid-1970s, EPRI has invested more than $80 million in acid deposition-related research alone.

EPRI's programs are intended to provide new technical information to support the development of informed decision-making. Our work has contributed substantially to an improved understanding of the environmental and economic risks associated with the acid deposition phenomena. Through EPRI's studies, many of the highly speculative early conclusions about environmental stress induced from atmospheric acidity have been placed in perspective relative to other stress factors. Through this research, we believe that the basis for considered decision-making is greatly improved today.

I am pleased to have this opportunity to present certain views to this Subcommittee on the issue of acid deposition. You have requested that I focus on the state of environmental science and technology for assessing the risks of decision-making. My framework for the presentation addresses your concerns about the timeliness and geographical sensitivity appropriate for possible national acid rain legislation. Some believe that the current political environment within Congress requires immediate consideration of sulfur oxide and nitrogen oxide emission control legislation to mitigate acid rain effects.* Consideration of legislation at this time involves a number of issues. These have been summarized in your letter of invitation. You have posed four questions of risk assessment:

1) What are the implications for human health and the environment of taking no action on acid rain?

2) If we choose to take action, which pollutants should be addressed?

3) What are the implications for human health and the environment of alternative levels of pollution control?

4) What are the implications for human health and the environment of alternative deadlines for achieving pollution reduction?

In this presentation, I will consider each of the questions, relying on EPRI's research results and experience, and the work of many investigators, as discussed, for example, in the interim assessment of the National Acid Precipitation Assessment Program (NAPAP). The results to date are summarized in Attachment 1. This summary indicates that the environmental effects are elusive and uncertain in character, even for heavily researched areas such as health effects, aquatic effects, visibility impairment, and materials damage. The effects could be judged to be quite modest relative to other risks borne by society.

Noted in Attachment 1 also are comments on the geographic areas of concern and the estimated rates of environmental change projected by recent research. The effects on aquatic and terrestrial ecosystems continue to be focused on certain sensitive areas of the East and alpine areas of the West. Most of the potential health effects (if any) and material damage are most likely to be local in urban areas where elevated concentrations of pollutants may be present. Visibility impairment may be pervasive at times in all parts of the United States. The role of air pollution varies, and does not necessarily correlate with reduced visibility.

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* $SO_x$ is defined as sulfur dioxide ($SO_2$) and sulfate ($SO_4$); $NO_x$ is defined as nitric oxide (NO) and nitrogen dioxide ($NO_2$).

The picture of present-day environmental stress from acid deposition in the United States suggests that no human health or ecological catastrophes are imminent. Evidence indicates that environmental change in the United States from human influence on deposition is slow, and has been retarded further by air quality improvement since the 1970s. Improvement is expected to continue with the restrictions of the Clean Air Act (CAA). Therefore, further emission controls for mitigation of acid-forming substances do not appear to be vital to air quality improvement.

If action is to be taken, legislation should complement the current direction of the CAA. If acidifying agents are targeted, control of both $SO_x$ and $NO_x$ should be considered to optimize reduction in acidity. However, it is important to note atmospheric oxidants, including ozone ($O_3$) and hydrogen peroxide ($H_2O_2$), are factors in many of the potential effects associated with acid-forming materials. Attempts made by the CAA to reduce oxidant levels (namely $O_3$) have focused on reduction in volatile organic carbon (VOC) vapors. Because of the complex nature of atmospheric chemistry, both VOC and $NO_x$ are involved in oxidant formation. Care needs to be taken about $NO_x$ reductions without regard for VOC levels because theory suggests that conditions exist where reduction in $NO_x$ can increase $O_3$ levels.

As environmental "insurance," one hardly can argue that further reduction in emissions of $SO_x$ and $NO_x$ would not be a prudent measure against the uncertainties in possible effects. However, the geographical priorities and timing are key issues if a decision to control is made. You have noted the possible use of emissions caps. Emissions caps are one means of pollution control. They have been used both at the federal and state level. They are most easily adopted with new technology; New Source Performance Standards are an example. Caps using retrofit or "repair" of older technology generally are very expensive and often create complementary problems.

It is not practical to completely eliminate man-made pollution. Even if it were, the costs would be so high that the "zero-discharge" approach would force economic hardship on industry that would be very disadvantageous economically.

Attempts to estimate environmental benefits generally suggest marginally small gains relative to the control costs. Even more importantly, such analysis indicates that there is little risk that significant ecological damage will be incurred if controls are delayed for 5 to 10 years, and that the benefits from a better informed control decision are substantial. These results stem, in part, from the difficulty in placing tangible value on national resources in pristine areas. In any case, there is substantial risk that proposed emission controls will place a needlessly heavy burden on the U.S. economy, already stressed in the world marketplace. This stress needs to be taken into account in developing an emission control policy. In this connection, it is worth noting a 1986 statement of the National Research Council, Committee on Electricity in Economic Growth,

> "To foster increased productivity, policy should seek to lower the real cost of electricity supply by removing any regulatory impediments and developing promising technologies to provide electricity."

Finally, the implications of alternate deadlines for achieving pollution reduction are difficult to ascertain. Surveillance of historic patterns of atmospheric (wet) deposition, as well as ambient air concentrations, has shown inconsistent changes with estimated emission changes. The record of experience to date does not lead to great confidence that environmental conditions would be improved over a given period -- though in the long term, and over large areas, one would expect improvements.

Clearly, legislation that could have immediate effect would be impractical both technologically and economically. Thus, a scheduled reduction is of greatest interest as a practical solution to environmental protection. Existing scientific results are not particularly helpful on the timing requirements since very little quantitative information is available on the rates of change in ecosystems or health indicators with deposition change. Qualitatively, results to date indicate slow or negligible adverse change in key environment indicators, so that time is available for careful decision-making and implementation.

Action involving additional emission control could be taken at planned increments over several decades. This approach favors a strategy to employ "new" clean fuel technologies currently reaching the demonstration stage. Choosing new technologies gives us the opportunity to improve energy generation and energy use efficiency. At the same time, these advances could provide greatly improved emission control. This option is much more positive than retrofit of existing plants that were built using pre-1960 technology. The new technology direction also offers major opportunities for the U.S. to demonstrate international leadership in re-establishing a premier position in efficient energy production.

As for geographical sensitivity, methods are available to estimate the impact of sources on specific areas of perceived high susceptibility. These methods are mathematical constructs (models) that describe the atmospheric physical and chemical processes translating emissions into acid deposition. Models are capable of estimating the consequences of geographically specific emission changes.

Since the 1980s, there has been persistent criticism of the ability of available models to link sources to receptor conditions. In response to these criticisms, considerable investment has been made to improve models so that they more faithfully describe our knowledge of atmospheric processes. Verification of the reliability of these models requires comparison with observed conditions. Even though the models themselves are greatly improved, verification with observations remains to be accomplished. This situation is being corrected with the acquisition of new data being obtained through participation in a major field program sponsored by U.S. electric utilities, the U.S. government and the Canadian government. This new data set will provide greatly improved evaluation and verification for all acid deposition models. This evaluation is needed to establish the reliability of models and their prediction to eliminate debate on this aspect of the decision process.

The application of new models will greatly enhance our confidence in undertaking a geographically-specific emission control strategy. Past model calculations are not considered reliable predictors of the future because of their conceptual limitations and mixed performance for simulating historical observations. Therefore, it would be prudent to avail ourselves of the results of the new model evaluations that will be reported in 1990. Then we can apply the "best available" exposure assessment technology to create a national control strategy.

Source-receptor models have been used to at least examine qualitatively geographically- specific emission control options for mitigation of possible acid rain effects. From past model calculations and from examination of a variety of observations, it is clear that an emission reduction plan based on uniform roll-back of all $SO_x$ and $NO_x$ emissions by state would be inefficient if protecting ecologically susceptible resources is the goal. For example, both observations and modeling studies show that the influence of emissions is strongly reduced with distance from a source. By focusing on nearby sources to susceptible areas, geographically-specific control strategies can be devised to maximize improvements at minimal national expense. Such scenarios have been proposed, but have not been favored for legislation.

In summary, a decision to undertake a national emission control strategy should be approached in terms of taking prudent, restrictive measures for environmental protection as an "insurance policy" for the future. In this context, cost effectiveness is a very important consideration. As you know, the costs are very high for emission control to mitigate the potential effects of acid rain. The commensurate environmental benefits are difficult to judge in terms of monetary or intangible value. A convincing benefit analysis should be the foundation for committing large amounts of money to an emission control program. Such a benefit analysis has not been done and may not be possible, despite the enormous investment in acid rain research by the national science program. At least, we should allow the NAPAP assessment to be completed in 1990 to see how far the heavy investment in scientific knowledge can take us toward an enlightened, cost-benefit based strategy for acid deposition.

Background material submitted with the statement was previously printed and will not be reprinted in this document.

The material is as follows:

Utility $NO_x$ Emissions and Urban Ozone, July 1988, Electric Power Research Institute.

Deposition of Air-borne Acidifiers in the Western Environment, J.R. Young, E. C. Ellis, and G. M. Hidy, Journal of Environmental Quality, Vol. 17, no. 1, January-March 1988.

Acid Deposition and the West, A Scientific Assessment, George M. Hidy, ERT, Inc. Document No. P-D572-503, March 1986

ATTACHMENT 1

## SUMMARY OF 1988 PERCEIVED EFFECTS OF ACID DEPOSITION(1)

| EFFECT | PERCEIVED EXTENT OF DAMAGE | COST SIGNIFICANCE | PERCEIVED RATE OF CHANGE | PERCEIVED GEOGRAPHICAL SENSITIVITY |
|---|---|---|---|---|
| Surface Water Acidification and Fishery Loss | Recent acidification only documented for a small fraction of susceptible lakes in the Adirondacks. | Ambiguous because of recreational fishing mobility. Aquatic ecology change intangible cost. | Believed to be slow or at steady state with present deposition rates. | Low alkalinity waters in Northeast, upper Southeast Midwest and Alpine areas of the West. |
| Forest Dieback | Primarily Red Spruce in East; Hardwood deterioration unsupported. Acid deposition only one of many stress factors. | Unclear because of ambiguous effect of acid deposition relative to other stresses. | Red spruce dieback in a few isolated areas. Forest health generally satisfactory with little or no unexplained deterioration. | Primarily eastern high altitude forests. Damage in West not observed except isolated high ozone exposure areas. |
| Crop Damage | Damage considered negligible. | none identified | n/a | n/a |
| Materials Damage | Primarily in cities with relatively high pollutant levels.<br>Paint damage potentially significant.<br>Loss of monuments and building facades potentially significant. | Uncertain, but potentially a substantial loss in cities. However, this "loss" is built into replacement maintenance costs. | Variable, but on scale of "years." | Mainly urban areas, localized. |
| Health Effects | Direct health effects-Unsubstantiated at ambient levels<br>No evidence of contaminated drinking water supplies or excessive heavy metal solubilization. | Uncertain but probably small except in urban extreme conditions covered by Clean Air Act. | CAA requires continuing improvement in reduced exposure. | Primarily focused on urban environment. |
| Visibility | Airborne sulfate is a major contributor, but is confounded by other major constitiuents of particles. | Despite efforts, the cost of significance of visibility reduction is difficult to establish. | Recent evidence in the East suggests improvement. The western conditions are uncertain. | Regional reduced visibility is prevalent in the East and parts of the West. Effec is confounded by weather conditions. |

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(1) Based in part on the NAPAP Interim Assessment, and in part on EPRI (and other institutional) research.

Mr. Sharp. Dr. Galloway, we're happy to hear from you now.

## STATEMENT OF JAMES GALLOWAY

Mr. Galloway. Thank you, Mr. Chairman.

The previous three speakers who I have grown to respect have affiliations they are representing. I am only a university professor and so I don't have an official affiliation. I don't speak for the University of Virginia. I do speak, however, as a scientist who has worked in the area for 14 years, this area of the impact of acid deposition.

The kinds of things I want to talk about today really have to do with change in the environment. How does one change the environment, for example, increased emissions of sulfur and nitrogen cause other changes in the environment, whether it is the increased acidity of precipitation with the impacts on receiving ecosystems, and how would another change to the environment, reductions in emissions, cause other changes—perhaps recovery of systems?

My job is not to say, however, whether you should or should not reduce sulfur and nitrogen emissions. My job is only to provide an objective analysis about what will happen if you do or do not regulate such emissions.

I have worked in the past few years, mostly on aquatic ecosystems and atmospheric systems. For that reason I am going to limit my remarks to the relationship between the atmosphere and aquatic ecosystems. I join with the other members of the panel, however, in saying that if you are going to regulate, you can't look at one thing out of the periodic table; you have to look at a variety of materials including sulfur, nitrogen and the VOC's.

I am going to speak very briefly about the current situation relative to environmental change. I'm going to talk about the future and address what will happen in the future if deposition of sulfur and nitrogen is not reduced and what will happen if it is reduced by a prescribed amount.

In the eastern United States, emissions of sulfur and nitrogen oxides overwhelm natural emissions by over a factor of 10. Deposition of sulfur and nitrogen has increased in the United States as has transport and deposition to Canada and the western Atlantic Ocean. Within the region of increased deposition are thousands, perhaps hundreds of thousands, of water bodies that are sensitive to increased deposition, sensitive to acidification due to increased sulfur and nitrogen deposition.

NAPAP and Canadian scientists and others have shown that there is regional scale acidification of sensitive aquatic ecosystems in southeastern Canada and the northeastern United States. Mr. Hidy and I disagree on this matter.

In the southeastern United States it has been shown that there are probably thousands of streams that are sensitive to acidification, but due to a different type of soil, they are slower to acidify. Nonetheless, they will acidify if emissions are not reduced.

As you acidify an aquatic ecosystem, as you reduce the pH, increase the acidity, reduce the pH below 6.0, biological changes occur, adverse biological changes. The pH does not have to be 5.0 to have a biological effect beginning. Biological effects don't occur just to fish. Fish are big. We eat them. They are popular items. Biological effects occur throughout the food chain, bacteria to fish. That is the current situation.

What of the future? I'd like to address two scenarios, a scenario of constant deposition and a scenario of decreases in deposition, and I would like to limit my remarks to sulfur. The wisdom of the moment, and I think it is sustained by a large amount of scientific knowledge, is that in the acidification of aquatic ecosystems it is sulfur that is the primary element that is causing this. Nitrogen in some limited cases has some impacts, but on a regional scale, chronic acidification, it is the increased deposition of sulfur that is the culprit.

Constant deposition—will changes still occur? In other words, from your perspective, if the Congress does nothing about decreasing emissions of sulfur and deposition of sulfur, will you still continue to have acidifications of aquatic ecosystems and biological effects? I think it is very important to keep in mind that it is not will lakes and streams still acidify or will they get worse with constant sulfur emissions, but the key question is will biological communities continue to change?

If lakes and streams acidify with no biological effects, we probably wouldn't be here today. It is the ecosystem level changes that are driving this concern. We need to break North America up into two pieces to consider this question, will changes still happen with constant levels of sulfur deposition, sulfur emissions?

The first area is the northeastern United States and southeastern Canada. It has been said that these areas are in steady state with respect to acid deposition. That is not true. In the northeastern United States and southeastern Canada there are some systems that even with their recent decreases in sulfur deposition we have are continuing to acidify. We don't know what percentage of the acidic systems are continuing to acidify. We do know there are some.

However, that is just the chemical acidification, the chemical effects of increased sulfur deposition. There are the biological effects also, and essentially all the evidence we have to date shows that even in lakes and streams with constant acidity over a course of time you have continuing biological effects. In other words, you don't have a lake turn acid and then you have biological effects occur like that, but rather you have a lake turn acidic and you have a progression of biological effects. In other words, the longer the lake or the stream is acidic the more severe the biological effects will become. There is a lag time in biological effects due to acidification.

In summary, for the northeastern United States and southeastern Canada, some of these systems are still acidifying, even with relatively constant sulfur deposition and many systems are still experiencing more biological effects.

What about the southeastern United States? As I mentioned before, there is a delay in acidification of these aquatic ecosystems. We now know that there is a large number of streams sensitive to acidification. They are only acidifying at a slight rate now because the soils' projections from models, what we have to do when looking at the future, show that these systems should continue to acidify in the decades to come with biological effects progressing along with the increased acidification of the streams, the sensitive streams in the southeastern United States.

If the Congress chooses to make no reductions in sulfur deposition, the consensus of the scientists that I am familiar with—the scientific literature that I am familiar with—say that in the northeastern United States, some systems will continue to acidify, many biological communities will have increasing damage to them and in the southeastern United States you will have both increasing acidification and biological damage going along with that.

Well, you have asked us some very specific questions about controls, about reductions in sulfur deposition. I'd like to break my answer into how much and how long. How much should sulfur be reduced and how long will it take to see some recovery of the systems I said are impacted?

How much? It is a pretty easy question to answer, actually, because we have the two end members. We know that in remote areas of the world you have about 2 kilograms of sulfur per hectare per year deposited in the remote, pristine, natural area. In eastern North America it is on the order of 20 to 30 kilograms of sulfur per hectare per year. Those are the two end members. If we wanted to go back to the natural world, which we can't do, we'd reduce sulfur emissions by 95 percent, but clearly that's unacceptable economically, politically, for whatever else you want to mention.

How much though do we have to reduce sulfur emissions to have recovery of some, perhaps most, aquatic ecosystems? The best scientific consensus to date is that deposition of sulfur should be on the order of about 10 kilograms of sulfur per hectare per year. It is about a factor of 5 higher than what occurs in the natural environment, so it is not being prescribed that you go back to the natural world to solve this problem of lake acidification. It is saying you have to make reductions over which you have now.

Keep in mind that the current level of deposition is on the order of 20-25 kilograms sulfur per hectare per year, so it is about a factor of 2 reduction in sulfur deposition, a 50 percent reduction in sulfur deposition. If you go back to emissions for some parts of the United States, it means on the order of a 50 percent reduction in emissions to keep some, probably the majority, of sensitive aquatic ecosystems to allow them to be able to recover.

How long will that recovery take if tomorrow we turned off the fossil fuel switch or reduced the emissions of sulfur by 50 percent? How long would it take to see recovery?

It is going to take longer than a Congressional term. It is going to take longer than several Congressional terms. There are three factors to take into account.

Mr. SHARP. Some people around here have lots of them, so——

Mr. GALLOWAY. There's three factors to take into account. There's physical factors, chemical factors, biological factors. Looking at it another way, there are three time lags to take into accounts—physical, chemical and biological. If tomorrow we reduce the emission of sulfur deposition by 50 percent, the physical factors are that—speaking of lakes, the turnover time of water in lakes, some lakes that have been acidified have residence times of 5 years for their water. That means it takes about three residence times to completely cleanse the lake of old water before the new comes in—that's 15 years. Most lakes, however, have residence times, most acidic or sensitive lakes have residence time on the order of a year to 2 years. Let's say about 5 years for physical recovery—new water goes in, old water comes out.

The chemical recovery will take probably a bit longer, because you have to have the new water coming from the atmosphere to become in equilibrium with the soils, and so there is a new chemical regime in the soil with some chemical reactions that don't happen spontaneously and that you would have to have a re-equilibration. That process is in the order of years also and is added onto, of course, the physical lag time.

In the northeastern United States it is estimated that it would be on the order of 5 to 10 years before you would have physical and chemical recovery, before you overcame the physical and chemical lag times. In the southeastern United States, it is longer. Because they are slower to acidify, they are slower to recover.

However, the most critical question is how long is the biological lag time. If you reduced emissions tomorrow, how long would it take biological systems to recover? Again, depending on the species, that is probably on the order of years. We have an excellent case in point in this real world of ours. Sudbury, Ontario has reduced emissions of sulfur by a large amount over the past few years and we can actually go back to those lakes and look at how rapidly they chemically recover and biologically recover. The lake has a high enough acidity that some species never recover, but it is a matter of years for biological recovery also, and that cannot occur until chemical recovery occurs.

In summary, let me say that with no reductions in emissions in the northeastern United States and southeastern Canada, you are going to have waters in the northeast United States and southeastern Canada, some, continue to acidify. You are going to have biological effects still begin to occur.

In the southeastern United States, biological effects and acidification will continue to occur.

With about a 50 percent reduction in sulfur emissions, aquatic ecosystems will recover on the order of about a decade in the northeast United States and greater than a decade in the southeastern United States.

Thank you very much.

[Testimony resumes on p. 67.]

[The prepared statement of Mr. Galloway follows:]

# TESTIMONY OF JAMES N. GALLOWAY
Professor, Environmental Sciences
University of Virginia
to the
Subcommittee on Energy and Power
of the
Committee on Energy and Commerce
U. S. House of Representatives, Washington, D. C.
Thursday May 26, 1988

## INTRODUCTION

I am a Professor of Environmental Sciences at the University of Virginia. I have been investigating the phenomena and effects of acid deposition for the past thirteen years and have published over sixty peer-reviewed papers on topics of long-range transport of acids, temporal and spatial trends in acid precipitation and the impacts of acid deposition on aquatic and terrestrial ecosystems. This research has been performed in North America, Australia, Asia, Europe, Africa and South America.

The purpose of this hearing is to determine the implications of reducing or not reducing the emissions of the substances that are causing increased acidification of the environment. The committee has posed a series of questions that address these issues. The following material presents my perspective on the subject with specific attention to the phenomenon of the acidification of aquatic ecosystems.

## STATE OF KNOWLEDGE:1985

The emission of sulfur and nitrogen to the atmosphere of the eastern United States has increased approximately by about 20 to 25 times over natural levels [NAPAP, 1987]. The increased emissions of sulfur and nitrogen oxides have resulted in decreases in visibility [NRC, 1986], deterioration of structures [NAPAP, 1987], acidification of surface waters and soils, with impacts on their biological communities [NRC, 1986; Schindler, 1988; NAPAP, 1987]. In addition, appreciable transport of sulfur and nitrogen oxides occurs across our borders with Canada [Galloway and Whelpdale, 1980] and the western Atlantic Ocean [Galloway et al., 1984]. This transport results in substantial impacts on the ecosystems of Canada [Cook et al., 1988] and a growing concern about impacts on the coastal waters of the United States.

The documentation of the impacts of acid deposition on aquatic ecosystems has been especially well developed for a number of years. In 1985, an *ad-hoc* group published a review of the existing information available for formulating policy for regulating acid deposition. The authors of the report perceived appreciable confusion and lack of awareness about the scientific information on acid deposition which had been generated over the preceding decade. To illustrate the degree of scientific certainty that existed on the subject, the group compiled the answers to a series of questions regarding the acidification of aquatic ecosystems from reports prepared by the Environmental Protection Agency [CARP, 1984], the National Academy of Sciences [NRC, 1981;

NRC, 1983; NRC, 1984], the White House Office of Science and Technology Policy [OSTP, 1984] and the Congressional Office of Technology Assessment [OTA, 1984]. The questions concerning aquatic ecosystems and the verbatim answers from the reports are as follows:

A. Have lakes and streams in the United States been acidified by acid rain?

- "Acid precipitation contributes to the greater-than-natural hydrogen-ion levels in some lakes and streams in eastern North America." [OSTP, 1984, p. III-2]
- "There is no question that fresh water bodies in sensitive areas have been altered." [OSTP, 1984, p. III-5]
- "Substantial evidence indicates that acid deposition alters water chemistry in sensitive lakes and streams." [OTA, 1984, p. 41]
- "Although there can be significant problems with comparing old and new data, overall, the analysis of temporal records shows recent decreases in alkalinity and pH in some otherwise undisturbed streams and lakes in areas receiving acidic deposition. As yet, no body of evidence exists suggesting that changes of such magnitudes, and at such rates, occur in otherwise undisturbed areas not receiving acidic deposition." [CARP, 1984, p. 4-167]
- "Although acidic waters do occur naturally, in some cases, and changing land use may locally alter the pH regime of surface waters, it appears that regional acidification and episodic pH depressions [pH <5.0] in clearwater oligotrophic lakes and streams occurs only in response to increased atmospheric deposition of strong acid. In areas not receiving acidic deposition, but with identical changes in land use, regional acidification of clearwater oligotrophic surface waters has not occurred." [CARP, 1984, p. 4-168]
- "Due to acidic deposition, $SO_4^{2-}$ concentrations have increased in aquatic systems in much of eastern North America. The increase in $SO_4^{2-}$ problem has to have been matched by an increase in $C_B$ or $H^+$. Since aquatic systems with original low alkalinities are characterized by watersheds with low $C_B/H^+$ ratios in the soil, a large portion of the increase in $SO_4^{2-}$ will have to be matched by an increase in $H^+$, i.e., decreased alkalinity." [CARP, 1984, p. 4-112]
- "There is empirical and theoretical evidence for lake and stream acidification." [NRC, 1984, p. 10]

B. What are the estimates of the past, current and future rates of acidification?

- "...about 3,000 lakes and 23,000 miles of streams have already become acidified, or have so little acid-neutralizing capability left that they are extremely vulnerable to further acid deposition. This corresponds to about 20 percent of the lakes and streams found in identified sensitive areas." [OTA, 1984, p. 43]
- "If sulfate deposition were decreased by 20 percent, OTA [1984] estimates that 10-25 percent of these water bodies might show improvement. If sulfate deposition were reduced by

30 percent, about 15 to 40 percent might show improvement. If sulfate deposition were increased by 10 percent, OTA, [1984] estimates that acid-alteration of lakes and streams might intensify by about 5 to 15 percent." [OTA, 1984, p. 43]

- "Scandinavian and North American studies appear to agree on one point: acidification of sensitive waters is detectable within one to two decades where pH values of precipitation are less than 4.6--a 10-fold increase in acidity over the theoretical "pure" rain pH value of 5.6. In areas where precipitation has pH values of 4.0 to 4.3, degradation is much more rapid. Changes in the pH or alkalinity of water bodies of small areas of Belgium, the Netherlands, and Denmark also have been recorded." [NRC, 1983, p. 153]
- "Theoretically, in lakes and streams impacted by acid deposition, where sulfate concentrations are still increasing, the alkalinity will continue to decrease. With respect to lakes and streams affected by acid deposition, where sulfate concentrations are stable, there is disagreement in the panel as to whether future alkalinity decreases will be gradual over the period of centuries or perceptible over years to decades. The disagreement stems from a lack of data." [NRC, 1984, p. 11]

C. Are there biological changes due to acidification of lakes and streams?

- "Although some kinds of lakes have been acid throughout their known history, others in areas subjected to acid deposition have become appreciably more acid during the past few decades. These changes in lake acidity have been accompanied by major changes in the biological activity within them, often including the disappearance of various aquatic biota, 1984, most visibly fish." [OSTP, 1984, p. III-2]
- "In lakes near very strong sources of sulfur dioxide, such as the smelters of Sudbury, Ontario, ecological effects have been severe. Thus, there can be no doubt that high loadings of acid can destroy the normal biology of a lake." [OSTP, 1984, p. V-4]
- "Fish are sensitive both to the acidity of water, and to toxic metals--primarily aluminum--that are released from the watershed under acid conditions. When waters become more acid than pH 5, many fish species are eliminated and major changes in lake ecosystems processes frequently occur. High acidity, toxic concentrations of metals such as aluminum, or some combination of the two appear to cause these changes." [OTA, 1984, p. 42]
- "Biological effects due to acidification occur for a few species near pH 6.0. Because the biological response to acidification is a graded one, continued pH declines below pH 6.0 will result in escalating biological changes, with many species adversely affected in the range pH 5.0 to 5.5. Long-term declines in pH, commonly to pH 4.5 to 5.0, have been observed for a number of lakes and streams in areas receiving acidic deposition. For the same waters, historical data and paleolimnological analyses indicate that pH levels were often mid 5's or higher prior to acidification. In addition, episodic depressions down to pH 4.4 to 4.9 often occur in low alkalinity waters during periods of snowmelt and heavy rainfall and can affect systems with a pH as high as 7.0. These pH levels, along with other changes associated with the

acidification process [e.g., increased aluminum, clarity, accumulation of detritus and algal mats], will have significant harmful effects on aquatic organisms. In water where pH values average below 5.0, most fish species, virtually all molluscs, and many groups of benthic invertebrates will be eliminated. Increased aluminum concentrations may eliminate fish species otherwise tolerant of low pH. The plankton community will be simplified and dominated by a few acid-tolerant taxa. Benthic algal mats will often cover the lake bottom, and water clarity may increase. These represent the best documented effects of acidification. Effects on ecosystem processes remain largely unconfirmed and are an important area for future research efforts." [CARP, 1984, p. 5-159]

- "Addition of acidic deposition to terrestrial and aquatic systems can disrupt the natural biogeochemical cycles of some metal and organic compounds to such a degree that they can cause biological effects. The chemical form of dissolved metals is important in determining the total mobility of a metal and the biological effects related to acidification of aquatic ecosystems. Acidification increases the concentration of many metals in surface waters and changes speciation toward more biologically active forms." [CARP, 1984, p. 4-168]
- "Acid deposition, due to the further oxidation of sulfur and nitrogen oxides released to the atmosphere by anthropogenic sources, is causing widespread damage to aquatic ecosystems, including loss of bicarbonate, increased acidity, and higher concentrations of toxic metals. As a result, several important species of fish and invertebrates have been eliminated over substantial parts of their natural ranges." [NRC, 1983, p. 182]
- "If lakes and streams have been acidified by acidic deposition then biological effects will follow. Because the chemical changes are for the most part gradual and variable, 15 years is too short a period over which to evaluate biological trends. However, streams and lakes acidified by acidic deposition have a different biotic structure than nonacidified streams and lakes." [NRC, 1984, p. 4]

D. If sulfur emissions are reduced, how long will it take lakes and streams to return to their previous chemical and biological conditions?

- "Lakes and streams require years or decades to recover from anthropogenic acidification once the acidic inputs are removed, with the recovery time depending on local geochemical factors, flushing rates, rates of species colonization, extent of alteration of trace-element composition, and other factors." [OSTP, 1984, p. III-5]
- "These systems have responded to increases in acid deposition in the past and will respond to future changes in acid deposition. In watersheds that retain significant quantities of sulfate, lakes and streams that have responded more slowly to acid deposition will continue to respond to past levels of acid deposition and will exhibit slow response to any future increase or decrease in acid deposition." [NRC, 1984, p. 8]

## STATE OF KNOWLEDGE:1988

At the time of the 1985 *ad-hoc* review, there was remarkable agreement that acidification of aquatic ecosystems on a regional basis was caused by acid deposition. Based on that agreement, the report concluded that adequate scientific information existed to select emission-reduction strategies to reduce acid deposition.

What has happened in the last three years? Has the evidence made available since the 1985 *ad-hoc* review strengthened or weakened the link between acid deposition and regional scale impacts on aquatic ecosystems?

The reports that have been published during the last three years have supported the 1985 *ad-hoc* review and have shown that the scale of regional acidification and the degree of ecosystem damage was greater than previously documented. For example,

- In eastern Canada it is now estimated that about 350,000 lakes are very sensitive [acid neutralizing capacity less than 50 ueq/l] to acidification [Cook et al., 1988].

- Acid deposition is responsible for the acid-base chemistry of surface waters. Nearly all the sulfate in surface waters can be ascribed to atmospheric deposition [Cook et al., 1988; Brakke et al., 1988a].

- Biological effects due to surface water acidification begin to appear at pH 6 [Schindler, 1988].

- The results of the NAPAP Eastern Lake Survey support the hypothesis that regional lake acidification has occurred in the northeastern United States [Brakke et al., 1988b].

- The results of the NAPAP Eastern Lake Survey support the hypothesis that some lakes in the upper Midwest have been acidified by acid deposition [Eilers et al., 1988].

- Southeastern streams of the southeastern United States, especially in mountainous regions, are being acidified by acid deposition [Swank and Waide, 1988; Smith and Alexander, 1983; 1986].

## WILL CONTROL LEAD TO RECOVERY?

This panel has been asked to address specific questions concerning the relationship between the control of acid deposition precursors and the recovery of impacted systems. This section of my testimony addresses these questions with specific reference to aquatic ecosystems.

*1. What are the implications for human health and the environment of taking no action on acid rain?*

If no action is taken on decreasing the atmospheric deposition of sulfur and nitrogen, the best available scientific evidence suggests the following:

- some surface waters in the northeastern United States and southeastern Canada will continue to acidify due to the net removal of neutralizing substances from the soils associated with the surface waters.
- surface waters in the southeastern United States will continue to acidify and will increase their rate of acidification.
- biological effects in acidified waters will continue to increase, even if the acidity of the water does not increase.

*2. If we choose to take action, which pollutants should be addressed? Sulfur dioxide only? What about nitrogen oxides and volatile organic compounds?*

The primary pollutant to control to limit the acidification of surface waters is sulfur dioxide. However, controlling only sulfur dioxide would be shortsighted due to the synergistic impact of sufur oxides, nitrogen oxides and oxidants on terrestrial ecosystems. Therefore, for the optimum impact of controls, sulfur oxide, nitrogen oxide and VOC emissions should be reduced.

*3. What are the implications for human health and the environment of alternative levels of pollution control? What are the implications of a simple cap on emissions? Of completely eliminating man-made pollution? Of any level of reduction in between?*

Eliminating human emissions is an impossible task, if only because anthropogenic sources of sulfur and nitrogen oxides so overwhelm natural sources. For example, in the case of sulfur, to make the anthropogenic emissions component equal to the natural component would require a 90% reduction in emissions. Therefore the appropriate question to ask is "What is the level of reduction in between 'no control' and 'total control'?". In the case of aquatic ecosystems that question is relatively easy to answer because of the preponderance of evidence linking sulfur emissions to aquatic ecosystem acidification.

By definition, remote areas of the world do not experience anthropogenic acidification of aquatic ecosystems. Therefore, the atmospheric deposition of sulfur in remote areas can be used as an estimate of the target loading necessary to eliminate anthropogenic acidification of aquatic ecosystems. The range of total sulfur deposition for remote areas is on the order of 1 to 3 kg S/ha/yr [Galloway, 1985]. This 'natural' deposition rate is small when compared to the rate in areas of the world impacted by anthropogenic activities [15 to 20 kg S/ha/yr]. The complete elimination of anthropogenic sulfur would require about an eight-fold reduction in sulfur emissions, from about 12 Tg S/yr to about 1 Tg S/yr for eastern North America. As mentioned above this is equivalent to about a 90% reduction in sulfur emissions and would be difficult to achieve. There have been investigations to determine how much of a reduction in sulfur emissions would be necessary to reduce deposition to a level that would protect some aquatic ecosystems but not necessarily the most sensitive ones. The estimated critical loads are generally within the range of 10 +/- 5 kg S/ha/yr for total sulfur deposition [Dickson, 1986; Henriksen et al., 1986; Henriksen and Brakke,1988; Oppenheimer, 1986; Schnoor and Stumm, 1987; Gorham, 1984; Wright et al., 1988; Schindler, 1988]. Thus from this analysis, it appears that a reduction of 50% in sulfur emissions is the least amount required.

4. *What are the implications for human health and the environment of alternative deadlines for achieving pollution reduction? What happens if Congress legislates requirements that take effect tomorrow? If Congress waits five years? Ten years? Fifteen years? Twenty-five years?*

This question can be rephrased to ask "What will be the impact of a delay in implementing emission controls on sulfur and nitrogen oxides?". To answer this question, the following information is needed:

- If a delay in reductions of sulfur and nitrogen oxide emissions occurs, will acidification of aquatic ecosystems continue?

Delays in emissions reductions will have the same result as no reductions. There will continue to be chemical and biological changes to aquatic ecosystems. Some aquatic ecosystems in the northeastern U.S. and southeastern Canada will continue to acidify. For those that do not increase their acidity, their biological populations will continue to degrade due to the continued stress of existing in acidic waters [Schindler, 1988]. The rate of both chemical and biological change will vary from ecosystem to ecosystem, but the important consideration is that these aquatic ecosystems will continue to change in areas of constant sulfur and nitrogen deposition.

In the southeastern U.S., sensitive aquatic ecosytems will continue to acidify due to the phenomenon of delayed acidification. The best evidence to date suggests that there are large numbers of these systems and that their acidification rate is on the order of about 1 ueq/l/yr.

- Once reductions, at the appropriate level, of sulfur and nitrogen oxide emissions occur, how long will it take for aquatic ecosystems to recover?

After appropriate reductions in sulfur deposition, there will be delays in the recovery of acidified aquatic ecosystems due to physical, chemical and biological factors. The delays caused by physical factors apply to lakes where the hydrologic residence time will limit how quickly the water of the lake is replaced. Lakes of the type that are acidified can have delays in recovery due to physical factors on the order of one to ten years.

The delay in recovery due to chemical factors will be controlled by how quickly the streams and the lakes obtain chemical equilibrium with the lower rate of atmospheric sulfur deposition. In regions where there has been rapid acidification of the aquatic ecosystems, such as the northeastern U.S. and southeastern Canada, the chemical recovery should be rapid, on the order of years. Evidence for this is available from Sudbury, Ontario, where a large decrease in sulfur emissions from the Sudbury smelter resulted in a decrease in acidity of lakes [Keller et al., 1986; Gunn et al., 1988]. Areas where the acidification of aquatic ecosystems has been delayed due to the nature of the soils will also experience delays in the chemical recovery of the ecosystems. Modeling evidence suggests that these delays will be on the order of decades [Cosby et al., 1985].

The recovery of the biological populations of lakes that have experienced chemical recovery will depend on a variety of factors [Schindler, 1988]. However, it is generally agreed that biological recovery will take several years longer than chemical recovery [Hultberg and Andersson, 1982; Yan and Dillon, 1984; Raddum et al., 1986]. In some lakes where the pH never dropped below 5.0, there is evidence that it takes phytoplankton populations on the order of ten years to recover [Yan and Dillon, 1984]. For zooplankton in Swan Lake, Canada, some aspects of the population dynamics show recovery over a five to seven year period when the lake pH increased from 4.0 to 5.2 [Yan and Stokes, 1988]. For the same lake, over the same period, fish and crustacea populations showed no recovery [MacIsaaz et al., 1986]. Studies on a manipulated lake indicate that after acidification to pH 5.0, several species of fishes and invertebrates were eliminated [Schindler, 1988] and that following recovery to pH 5.4 to 5.6, two of the remaining species of fishes resumed reproduction and several species of phytoplankton returned. However, lake trout did not resume reproduction and other species eliminated from the lake did not return [Schindler, 1988]. For some aquatic ecosystems that have been heavily acidified, recovery may never occur [Yan and Dillon, 1984].

Thus the evidence suggests that the biological recovery of aquatic ecosytems following decreases in acid deposition may be delayed by years to decades.

## SUMMARY

The emission of sulfur and nitrogen to the atmosphere of eastern North America by anthropogenic activities overwhelms natural emissions. The resulting increases in the atmospheric deposition of sulfur, primarily, and nitrogen to some extent, has resulted in the acidification of aquatic ecosystems on a regional scale in the northeastern U.S. and southeastern Canada. In addition it will probably result in the regional acidification of stream ecosystems in the southeastern U.S. over the next ten to twenty years.

If there are delays in the reduction of sulfur and nitrogen emissions to the atmosphere there will continue to be adverse chemical and biological changes to low alkalinity aquatic ecosystems in eastern North America. A fifty percent reduction in the emissions of sulfur to the atmosphere of eastern North America will result in the recovery of some of the acidified aquatic ecosystems. In northeastern U.S. and southeastern Canada the time scale of chemical and biological recovery will be on the order of a decade; in the southeastern U.S. it will be greater than a decade.

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Mr. Sharp. Thank you very much, Dr. Galloway.

Dr. Friedman.

## STATEMENT OF ROBERT FRIEDMAN

Mr. Friedman. Thank you, Mr. Chairman. I'm Bob Friedman, a senior associate with the Office of Technology Assessment. I've been directing OTA's Clean Air Act-related assessments since about 1980, including a study of acid rain completed in June of 1984. Much of my testimony today is drawn from that assessment.

We considered the problem to be broader than acid rain, and looked at other transported air pollutants as well, including ozone and fine particles, such as air borne sulfates. We characterized the issue as a trade-off, the trade-off between risks of damage and the costs and secondary consequences of control.

In our report, we discussed a series of decisions that Congress must make, both technical ones and ones of a more social and regulatory nature, and present options under each.

I will restrict my remarks this afternoon to the two decisions that are central to this hearing today, tons and time. That is, by how much do we reduce pollutant emissions and by when.

Since, in our opinion, sulfur dioxide is the logical first choice for control, I'll focus my remarks today on that pollutant.

The decision on how much to reduce emissions must take into account two very important components; (1) the scientific question of the relationship between emissions reductions and resource protection, and, (2) the policy question of what is the socially-desirable level of resource protection.

Several reference points are available which I think you'll find helpful, though these reference points will, by necessity, be best guesses with considerable uncertainty.

First, let me go back to something that Dr. Galloway mentioned. Several groups have estimated maximum levels of acid deposition that the most sensitive lakes and streams could receive without undergoing further damage. Specifying deposition limits to protect against damage to such other resources as forests or materials is not yet possible.

Let me hazard an opinion about how the magnitude of emissions reductions proposed in the principal House bills of the 99th and 100th Congresses stack up to this reference point.

We estimated that in some areas with high deposition, for example, northern New England and the upper Midwest, reducing sulfur dioxide emissions 8 to 10 million tons per year below current levels might be sufficient to bring deposition levels within the estimated targets for protecting—and this is important—all but the most sensitive aquatic resources.

In areas of highest deposition, however, such as parts of Pennsylvania, West Virginia, and New York, this level of protection might not be achievable through sulfur dioxide emissions cutbacks of this magnitude.

Whether this is the desired level of protection must be addressed, however. Because some resources in some areas will not be completely protected, some in Congress have called for control programs that mandate $SO_2$ reductions in the range of 12 million tons per year.

Several preliminary analyses indicate that even greater reductions might be needed to protect all sensitive aquatic resources in all areas.

Similarly, one must question whether protecting all but the most sensitive lakes and streams in most areas is being overprotective. That is, does this strike the socially-desirable balance between costs of reductions and resource protection benefits?

This leads me to the second reference point relevant to this decision, the costs of emissions reductions. Somewhere in the range of about 8 to 10 million tons, the costs of additional reductions begin to rise dramatically.

On a dollar-per-ton basis, the last few million tons past this point are about twice as expensive, on average, than the first 8 to 10 million.

Increasing reductions to 10 million tons per year, for example, as proposed in a report of this Congress from the Senate Committee on Environment and Public Works, would be more protective, but would raise costs considerably over the principal House bills.

The third reference point that Congress might want to consider is an estimate of the economic benefits of control to compare to the costs. At least one study has tried to do this, a report prepared for EPA for a purpose other than acid rain.

The study estimates that the benefits from sulfur dioxide reductions of about 5 million to 10 million tons per year in the east would be in the range of $2 billion to $6 billion per year, about the same range as the costs.

Most of the benefits in the EPA analysis come from lowered concentrations of air-borne sulfate, such as improved visibility and reduced illnesses, effects sometimes overlooked by too-narrowly defining the acid rain issue.

While these dollar benefit estimates are uncertain, at best, it is significant, at least in my opinion, that they put the benefits of $SO_2$ control in the same order of magnitude as the costs. Benefits might be several times lower or higher than costs.

This conclusion, I believe, applies to both ends of the range, for both a 5 million ton program and a 10 million ton program. Lowering emissions by 5 million tons will provide about half the benefits of lowering emissions by 10 million tons and cost about half as much, as well.

The second major issue that I'd like to touch on this afternoon is the question of timing of emissions reductions. This decision focuses on the trade-off between the risk of resource damage from continued levels of acid deposition and the risk of inefficient or unnecessary control expenditures from controlling too early.

Throughout the discussion it is necessary to keep in mind that further emissions controls would take, at minimum, about 6 to 10 years to implement, given the planning, contracts, construction, and other steps necessary.

On one side of the trade-off is both living with current levels of damages and risks—altered lakes, visibility degradation, and human health risks—and the risk that damage will worsen in the future, because damage to at least some resources is cumulative.

That is, damage depends on both the intensity of the exposure and the number of years it remains high. Delaying action will cause some additional harm.

However, assuming that we can generalize from aquatic ecosystems—and that's a risky assumption, at best—the difference between the level of harm in, for example, 1998 to 2003 would probably not be dramatic.

When considering whether to delay a reduction deadline from, say, 1998 to 2003, one should probably ask oneself the following question: By around 2000 and beyond, for those resources that might take decades to recover, will 5 or more years of continuing resource damage be acceptable?

On the other side of the trade-off is the risk of inefficient or unnecessary control expenditures by acting too soon. Stretching the compliance deadline an additional few years might lower control costs somewhat and ease some job losses, both desirable outcomes. I cannot, however, offer specific estimates of the economic benefits to be gained.

An additional few years of research will certainly lead to greater understanding of the problem, but I strongly doubt that our knowledge of the other resource and health concerns would even approach the level of understanding that we have today for lakes.

I expect that the scientific debate over the benefits of reducing emissions will still be vigorous in 1990 when NAPAP completes its assessment, and with as much disagreement as today.

Thank you for the opportunity to testify. I'd be happy to provide copies of the summary or our complete assessment of acid rain and transported air pollutants.

[The prepared statement and attachment of Mr. Friedman follows:]

## TESTIMONY OF DR. ROBERT FRIEDMAN, OFFICE OF TECHNOLOGY ASSESSMENT

## BEFORE THE SUBCOMMITTEE ON ENERGY AND POWER HOUSE COMMITTEE ON ENERGY AND COMMERCE

## HEARING ON ACID DEPOSITION, MAY 26, 1988

Good Afternoon. I am Robert Friedman, a senior associate with the Office of Technology Assessment. I have been directing OTA's Clean Air Act-related assessments since 1980, including an assessment of acid rain completed in June, 1984. More recently, I have focused on ground-level ozone, another widespread air pollution problem.

Much of my testimony today is drawn from our assessment, "Acid Rain and Transported Air Pollutants: Implications for Public Policy". While much has been learned from the research efforts of hundreds of U.S., Canadian, and European scientists since we published our report, I believe you will find the policy framework presented in the report still quite relevant.

Our report characterized the problem as not just acid rain, but acid rain and other transported air pollutants, including ozone and fine particles such as airborne sulfates. Transported air pollutants affect lakes and streams, crops, materials, visibility, forests and human health. From a policy perspective, it is important to focus on pollution transport because the Clean Air Act addresses local air pollution problems but does not directly apply to pollutants that travel many miles from their sources.

We characterize the issue as a tradeoff -- the tradeoff between risks of damage and the risks from controlling pollutant emissions. We discuss both sides of this issue -- the effects of transported air pollutants and the costs and secondary consequences of control.

We present the issue as series of decisions that Congress must make, and present options, rather than recommendations, under each decision. The first decision, of course, is whether to enact a control program now -- that is, this Congress or the first session of the next -- or wait for the results of the NAPAP assessment. This, of course, is a very important decision. For convenience, however, I will skip over this decision and return to it when I discuss the issue of timing of an emissions control program.

Assuming one decides to enact a control program, we talk about a series of eight decisions that Congress must make. These include a series of four "technical" decisions:

1. *Which pollutants should be controlled?* One must choose from the three major pollutants from which transported air pollutants form -- sulfur dioxide, nitrogen oxides and volatile organic compounds (VOCs). All of the major bills go after sulfur reductions first. In the eastern United States, sulfur compounds are responsible for about two times

more acidity in precipitation than nitrogen compounds. Sulfur compounds are known to be related to lake and stream acidification, visibility degradation, materials damage and are implicated in human health effects. Many of the major bills of the 99th and 100th Congresses, recognizing that nitrogen oxides and more recently ozone, may also be problems, seek to achieve some reductions in nitrogen oxides. Since sulfur dioxide is the logical first choice for control, I will focus my remarks today on that pollutant.

2. *How geographically widespread should a control program be?* Over the last four Congresses, most bills have either required reductions in the eastern-most 31-states or across the contiguous 48-states.

3. *By how much should emissions be lowered?* The range of sulfur dioxide emissions reductions in most bills has been between 8 million and 12 million tons, but lower reductions would also be helpful. As this is one of the major questions you asked me to address in my testimony, I will discuss this in some detail later.

4. *By what time should reductions be required?* Again, I will discuss this in more detail later in my testimony.

In our assessment we also discuss a series of four decisions of more of a social and regulatory nature, including: What approach to control should be taken --"source-based" regulation or "environmental quality" standards? How should emissions reductions be allocated to States or sources? Who should pay the cost of emissions reductions, that is, should the costs of control be spread through some form of cost-sharing program? And finally, what can be done to mitigate undesired employment and economic effects of a control program? I understand that these last four decisions will be discussed at future hearings so I will not address them further today.

I will restrict my remarks to the two decisions that Congress must make which are central to this hearing today: "tons and time", that is, by how much do we reduce pollutant emissions and by when. I will tell you the bottom line of my testimony first: *There is no scientific information that unequivocally forces the policy decision to a single emissions reduction level or to a single reduction deadline. Nor is this situation likely to change in the near future.* I will give you a few relevant scientific and economic "reference points" against which each of you can apply your own values, though these reference points will by necessity be best guesses with considerable uncertainty.

## BY HOW MUCH SHOULD WE REDUCE EMISSIONS?

The decision on how much to reduce emissions must take into account two important components: 1) the *scientific question* of the relationship between emissions reductions and resource protection, and 2) the *policy question* of what is the socially desirable level of resource protection. The latter involves such policy concerns as balancing the costs of reductions with the expected resource-protection benefits, and distributing the risks and costs equitably among different groups and geographic areas.

Several reference points are available which I think you will find helpful:

**Protecting lakes and streams**

First, several groups have estimated maximum levels of acid deposition that most sensitive lakes and streams could receive without undergoing further damage. Specifying deposition limits to protect against damage to such other resources as crops, forests, or materials is not yet possible.

In our 1984 report we reviewed a few of these, including those based on two National Research Council reports that we heard about earlier this morning. Several additional approaches have been developed since that time, and progress has been made in our understanding of how emissions reductions would affect deposition levels. Our earlier conclusions, I believe, are still valid: In areas of highest deposition -- e.g., parts of Pennsylvania, West Virginia, and New York -- reducing sulfur dioxide emissions 8 to 10 million tons per year below current levels *might not* be sufficient to bring deposition levels within the estimated targets for protecting *all but the most sensitive* aquatic resources. In areas of lower deposition, such as northern New England, and the upper Midwest, the recommended deposition limits *might* be achievable through sulfur dioxide emissions cutbacks of this magnitude.

Risks of damage to materials and sensitive forests -- for example, high elevation spruce forests -- would also be reduced. In addition, airborne fine-particulate levels would be lower, improving visibility and reducing risks to human health.

Whether this is the *desired* level of protection must be addressed, however. I have chosen the range of 8 to 10 million tons because this is the level of emission reductions proposed in the principal House bills in the 99th and 100th Congresses. Under such control programs, some resources in some areas will not be completely protected; thus some in Congress have called for control programs that mandate sulfur dioxide reductions in the range of 12 million tons per year. Several preliminary analyses indicate that even greater reductions might be needed to protect all sensitive resources *in all areas.*

Similarly, one can question whether protecting all but the most sensitive lakes and streams in most areas is being *overprotective.* If an emissions control program were free and without any negative consequences, I'm sure no-one would object to even the most stringent control program. But as you know, control programs are not without cost.

**Control costs**

This leads me to the second set of reference points relevant to this decision: the costs of emissions reductions. Reducing emissions by about 8 to 10 million tons of sulfur dioxide per year below current levels (including offsets for expected new growth) would cost about $3 to $5 billion per year, depending on the design of the program. Increasing this to 12 million tons per year -- for example as proposed in a bill reported this Congress from the Senate Committee on Environment and Public Works -- would be more protective, but would raise costs considerably. Somewhere in the range of 8 to 10 million tons the costs of additional reductions begin to rise dramatically. On a dollar per ton basis, the next few million tons of emissions reductions past this point are about twice as expensive, on average, than the first 8 to 10 million.

Congress might also decide that a smaller emission reductions program might be considered more appropriate until more is known about the extent of the risks to sensitive aquatic resources, forests, materials, and human health. For expenditures of about $1 to $2 billion per year, about 4 to 6 million tons of sulfur dioxide can be eliminated annually, depending on the design of the program. This might stand alone, or as some have proposed, serve as the first phase of a larger control program. What can we say about the benefits of such reductions? Though there are few analyses to rely on, I think it is fair to expect that lowering emissions by 5 million tons will provide *about* half the benefits of lowering emissions by 10 million tons. My guess could easily be off a fair amount in either direction.

**Comparing economic benefits to costs**

This leads me to the third reference point that Congress might *hope* to consider: estimates of the economic benefits of control, to compare to the costs. In our 1984 report, we were not able to estimate the dollar benefits from lowering sulfur dioxide emissions. Since that time, however, at least one study has tried to do this -- a draft regulatory impact analysis of several alternative ambient air quality standards for sulfur dioxide, prepared by EPA[1]. In that document, they look at two alternative standards that would achieve reductions of sulfur dioxide emissions of about 5 million and 10 million tons per year in the East. The corresponding benefits were estimated to be in the range of $2 billion to $6 billion per year. While these estimates are uncertain, at best, it is significant, in my opinion, that they place the benefits of sulfur dioxide control in the same "order of magnitude" as the costs. Benefits might be several times lower or higher than costs. This conclusion applies to both ends of the range -- for both a 5 million ton program and a 10 million ton program. To me, this once again implies that a decision by the Congress about how much to reduce emissions must be a judgment call based on who should bear the burden of uncertainty -- those who stand to benefit from control or those who will bear its cost.

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[1] "Regulatory Impact Analysis on the National Ambient Air Quality Standards fo Sulfur Oxides (Sulfur Dioxide)", Draft, May 1987, Prepared by the Strategies and Air Standards Division, Office of Air and Radiation, U.S. Environmental Protection Agency.

Most of the benefits in the EPA analysis come from lowered concentrations of airborne sulfate, including improved visibility, reduced illnesses, and reduced air-pollution-related household soiling -- effects sometimes overlooked by too narrowly defining the "acid rain" issue. Aquatic resource damage, the basis for choosing an emission reduction target that I discussed earlier, is not included in that analysis. This illustrates an important limitation of the benefit/cost approach: Even if one could rigorously quantify both the benefits and costs of emissions reductions, many of the resources at risk from continued acid deposition, such as lakes and forests, provide benefits that cannot be estimated solely in economic terms. Similarly, some of the consequences of controlling emissions (for example, losses in employment in the high-sulfur coal industry from emissions reductions) may cause greater hardships than estimates of lost income indicate. Finally, benefits and costs of controlling transported pollutants differ substantially among various economic sectors and geographic areas within a control region. Calculating aggregate benefits and costs for the entire affected region ignores these distributional effects.

## BY WHAT TIME SHOULD REDUCTIONS BE REQUIRED?

The second major issue that I would like to touch on this morning is the question of timing of emissions reductions.

This decision focuses on the tradeoff between the risk of resource damage from continued levels of acid deposition, and the risk of inefficient or unnecessary control expenditures from controlling early. Throughout the discussion, it is necessary to keep in mind that further emissions controls would take at minimum about 6 to 10 years to implement, given the planning, contracts, construction and other steps necessary to significantly reduce emissions.

On one side of the tradeoff is both living with current level of damages and risks -- altered lakes, visibility degradation, and human health risks -- and the risk that damage will worsen in the future. Many feel that current damages and risks are large enough today to warrant lowering emissions to begin recovery. The longer the schedule of emissions reductions, the longer it will take before the situation improves. And some types of damage may, for all practical purposes, be irreversible.

Because damage to at least some resources is cumulative -- that is, damage depends on both the rate of deposition and the number of years it remains high -- delaying action will cause additional damage. For some resources in some areas, for example lakes in the Northeast, much of the damage from acid deposition that is likely to occur may already have happened. Even in the Northeast, however, we have yet to be sure whether this means that the number of acidified lakes in the Northeast will remain at current levels or double over the next several decades. In other areas, for example the Southeast, additional aquatic resource damage is likely under constant deposition levels, but the rate would probably be slower. Significant changes might occur over a time scale of 50 or 100 years. The uncertainty about the rates of change of damage to other types of resources of concern -- materials, forests, etc. -- is so great, that even tentative conclusions like those above are premature.

However, assuming that we can generalize from aquatic ecosystems -- a risky assumption, at best -- the time scales of change are long in comparison to the *differences* in deadlines among most of the current legislative proposals. This is not to say that additional resources will not be damaged by the year 2000 -- the opposite seems more likely -- only that the difference between the level of harm in, for example, 1998 and 2003 would probably not be dramatic. When considering whether to delay a reduction deadline from 1998 to 2003, one should probably ask oneself the following question: By around 2000 (and beyond, for those resources that might take decades to recover), will five or more years of continuing resource damage be acceptable?

On the other side of the tradeoff is the risk of inefficient or unnecessary control expenditures by acting too soon. Stretching the compliance deadline an additional few years might lower control costs somewhat and ease some job losses, both desirable outcomes. I cannot, however, offer specific estimates of the economic benefits to be gained. An additional few years of research will certainly lead to greater understanding of the problem, but I strongly doubt that our knowledge of the other resource and health concerns would even approach the level of understanding that we have today for lakes. I expect that the scientific debate over the benefits of reducing emissions will still be vigorous in 1990 when NAPAP completes its assessment, and with as much disagreement as today.

Thank you for the opportunity to testify today. I will be happy to provide copies of the summary or of our complete assessment of "Acid Rain and Transported Air Pollutants" to any of the subcommittee members or staff who would like further details about my remarks today.

# OTA REPORT BRIEF

June 1984

# Acid Rain and Transported Air Pollutants

## THE PROBLEM

Acid rain, ozone, and fine particles such as airborne sulfate are endangering U.S. resources. These air pollutants have harmed lakes and streams, lowered crop yields, damaged manmade materials, decreased visibility, and may be threatening forests and even human health.

However, finding an equitable solution is a major policy challenge. Controlling these pollutants will involve substantial costs—higher electricity rates, and in some cases, fewer jobs for miners of high-sulfur coal and financial strain to utilities and industries.

Until recently air pollution was considered to be a local problem. Evidence now indicates that winds carry air pollutants hundreds of miles, often crossing State and national boundaries. For example, sulfur pollutants that are deposited over most of the Eastern United States, have typically traveled about 200 to 600 miles. These "transported" air pollutants are not directly covered by the Clean Air Act, the main Federal air quality law.

OTA has synthesized what is known about pollutant emissions, movements, and effects, and presents estimates of potential damage to resources if pollutant emissions are not curtailed. In addition, OTA focuses on the public policy implications of the acid rain problem—the geographic distribution of risks and costs, as well as the potential effectiveness of various control options.

Acid deposition, commonly called "acid rain," occurs when sulfur dioxide and nitrogen oxides—released primarily from burning of fossil fuels—return to the earth as rain, snow, fog, dew, and as dry particles and gases.

Acid deposition is high in most of the States east of the Mississippi as far south as Tennessee and North Carolina. Enough acid pollution is deposited throughout this area to harm aquatic life in lakes and streams located in geologically sensitive watersheds. OTA estimates there are about 3,000 lakes and 20,000 miles of streams, scattered throughout the Eastern United States, that are extremely vulnerable to acid deposition or already are acidic.

Also, sulfur pollutants accelerate the deterioration of many economically important materials, including iron and steel, zinc, paint, and stone. Sulfate particles in the air are the single greatest factor in reducing visibility in the Eastern United States, responsible for about half of the decrease in visibility annually and even more during the summer.

Though research on the effects of current levels of airborne sulfates and other fine particles on human health is not yet conclusive, there is a reasonable risk that these pollutants may increase mortality rates by a few percent. Some researchers believe there is a negligible effect while others find a significant association, primarily among people with cardiac and respiratory problems.

Ozone is produced when nitrogen oxides interact with hydrocarbons. High ozone concentrations extend from the mid-Great Plains States to the East Coast, overlapping much of the region exposed to high levels of acid deposition. Ozone is causing about a 6 to 7 percent loss of U.S. agricultural productivity, overall. Reducing ozone to natural background levels would increase yields of corn and wheat by a few percent, soybean yields over ten percent and peanut yields by one-fourth.

Over the past 20 to 30 years, productivity of several species of trees has decreased in parts of the Eastern United States and Europe where high levels of air pollution prevail. Acid deposition, ozone, or a combination of both, as well as other stresses, such as climate fluctuations and disease, are being investigated as possible contributors to this problem.

During 1980, about 27 million tons of sulfur dioxide and 21 million tons of nitrogen oxides were emitted in the United States. Approximately 80 percent of the sulfur dioxide and 65 percent of the nitrogen oxides came from the 31 States bordering on or east of the Mississippi River. If energy use patterns and current laws do not change, both sulfur and nitrogen pollutants will remain high for at least the next half century —long enough to be significant to natural ecosystems.

Most of the control programs proposed in recent sessions of Congress have aimed at reducing sulfur dioxide emissions by 8 million to 10 million tons per year below 1980 levels. This level of reduction is likely to protect many sensitive aquatic resources in most areas. Risk of damage to forests, agriculture, materials and health would be reduced, and visibility would improve. However, in areas receiving the highest levels of deposition, some damage may still occur.

Such programs, however, are not without cost. Electric utilities account for about three-fourths of the sulfur dioxide emitted in the Eastern United States. Therefore, electricity consumers would ultimately pay a large share of the costs of an emissions control program. Electricity rates would increase an average of 2 to 5 percent—rising as high as 10 to 15 percent in a few Midwestern States under the more stringent proposals. If restrictions are not placed on control methods, about 20,000 to 30,000 jobs could shift from Eastern high-sulfur coal producing regions to Eastern and Western regions that mine low-sulfur coal.

*(over)*

## CONGRESSIONAL OPTIONS

Transported pollutants pose a special problem for policymakers: balancing the concerns of those who bear the risk of damage with those who will pay the costs of control. Scientific uncertainty about many aspects of the problem complicates the decision of whether or when to control. Unfortunately, additional scientific research will not provide an unambiguous answer in the near future, nor will it ever resolve value conflicts.

Four approaches for congressional action on acid deposition and other transported air pollutants are discussed in the report:

- Mandating emissions reductions to further control the sources of transported pollutants.
- Liming lakes and streams to mitigate some of the effects of acid deposition.
- Modifying the current Federal research program so it provides more timely guidance for congressional decisions.
- Modifying existing sections of the Clean Air Act to enable the Environmental Protection Agency, States, and countries to more effectively address transported air pollutants.

Legislation to address the problem of transported air pollutants could include options from any combination of the four approaches.

If Congress chooses to further control pollutant emissions, a number of interrelated choices must be made, including which pollutant emissions to reduce, from what sources and regions, by how much, and over what time period. Congress must also choose methods to implement the reductions, allocate the costs, and address any undesired secondary consequences of the emissions controls.

Sulfur dioxide would logically be included in any control program, since sulfur compounds contribute twice as much as nitrogen compounds to acidic rainfall in the Eastern United States
implicated with adverse effects
air pollutants are emitted and
to 30-State area of the Eastern U
sitive resources distributed throughout—any control program must at least encompass this area. For a nationwide control program, both sulfur dioxide and nitrogen oxides should be considered.

A modest sulfur dioxide control program—eliminating 2 million to 5 million tons per year—could be achieved for about $1 billion per year. This would offset expected emissions increases from utility and industrial growth, and might decrease emissions by a few million tons by 2000.

A large-scale program, reducing emissions to 8 million to 10 million tons below 1980 levels, would cost about $3 billion to $6 billion a year. Such emissions reductions would protect many sensitive resources, though some risk of damage would still be present. If larger reductions in emissions are desired, costs will increase markedly.

While the "polluter pays" philosophy is the traditional approach to environmental regulation, some have suggested that the costs of control be spread to a larger group through such mechanisms as a tax on electricity or emissions. This would lighten the financial burden to the heavily industrialized Midwest. To minimize shifts in coal-mining jobs, controls that allow continued use of high-sulfur coal could be subsidized or mandated. Direct control costs, however, could increase by as much as 25 to 50 percent.

*Copies of the OTA report, "Acid Rain and Transported Air Pollutants: Implications for Public Policy," are available from the U.S. Government Printing Office. The GPO stock number is 052-003-00956-1; the price is $9.50. Copies of the report for congressional use are available by calling 4-8996. Summaries of reports are available at no charge from the Office of Technology Assessment.*

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Address: OTA, U.S. Congress, Washington, D.C. 20510. Phone: 202/224-8996. John H. Gibbons, *Director*.

Mr. Sharp. Thank you very much, Dr. Friedman. The Chair's now going to recognize each of our members on the panel for 5 minutes each, and then we'll come back for additional rounds of questions.

Dr. Friedman, you've closed on my opening question, which actually is an appropriate closing to the opening remarks of Dr. Mahoney, where Dr. Mahoney was trying to outline, as I understood it, what additionally we ought to expect out of the NAPAP assessment program over the next 2 years.

And I guess what I would like is a brief comment, if you can, from each member of the panel as to where qualitatively you think we'll be in the debate 2 years from now after NAPAP completes it.

Are we going to have sufficiently additional information that there will be a stronger consensus that would help guide us on whether to act or not to act, or how to act, or how much and how long?

In other words, what we can learn over the next 2 years, do you think it can have a significant impact on the choices that we in Congress will have to make?

Dr. Mahoney.

Mr. Mahoney. Thank you, Mr. Chairman. I guess I'll try to give a response to defend my statement from before. For reasons of time, I reduced the discussion of what was in my prepared statement.

I would like to point out that I see three special aspects of our NAPAP in these last 2 years as being sort of qualitatively different, not simply a matter of getting certain more information, but really dealing with putting it together in a structured form.

First of all, we are publishing in the next few months an extensive plan for the contents and approach adopted in that 1990 assessment. And I think the very structuring of the plan is the first part of that added information.

Mr. Sharp. Right. Let me ask you. Does that mean that, when you have a document out there in the next couple of months, that other scientists and those of us lesser lights will be able to look at that and say: Here is the kind of thing we're going to know much better 2 years from now, and other scientists will be able to advise us as to whether or not we can really expect to get——

I mean that's not going to be just a sketching out of what's to come.

Mr. Mahoney. That's correct, Mr. Chairman. The point of this is that we are trying to lay out in a way that has never been done before a clear definition of the effects being addressed, how we describe their severity and their extent, and then the rest of the plan is laid out in the form of series of explicit questions to be addressed, and indicates the kind of information that will be provided in response to those questions.

We're making those questions as direct as possible. Where are the effects especially sensitive? What is their scope now? How much will they change under various scenarios? How do we value those benefits or improvements and the like?

That whole plan is being published specifically to invite broad comment. We've announced a plan for a major national public hearing, which will be open to non-U.S. citizens, too.

We intend to receive comment back from the broad scientific community, and from the user community. And the whole thing is cast in a form to say that, now that we've come this far along in the process, we want to lay down specifically how we will ask questions, what we think we can provide as information, and hear from all of the intended users about that, whether we've asked the right questions.

And, as we've announced in our plans, we will then modify that plan, publish it in a final form—our target is the end of the year—and then we will work to that plan in delivering information through 1990.

So, that's at the core of something that we think is different. As you've heard all these various views today, we believe the one matter lacking most broadly is this idea of how to prioritize and organize all the information we have to address these kinds of issues.

I think the one other thing I'd put in it, and conclude my answer with that, is that we all recognize the question of uncertainty. One major part of this plan, as we're now dealing with it in draft form, is the question of uncertainty.

We intend to lay out a means to attach the best description we can to the problem of uncertainty for everything that would be said. There's a ranking involved in this.

Some conclusions reported can be stated as broadly agreed upon by virtually everybody. And there's a ranking scale. It starts from that point and goes right on down to unsupported hypotheses, and we've heard a lot of those.

And there's some important middle areas, things that are quite generally agreed, but we have a lot of questions about.

So, it's this whole assessment process, really pulling it together, that we intend to be the pay-out of the $500 million investment the Nation will have made in the research under NAPAP by the time we present these final reports in 1990.

Mr. SHARP. Do you think, when your final reports come out, that you, as a scientist, will feel comfortable coming to us and saying: I either believe we should do nothing or I believe we should go for a program of some 6 to 8 or 12 to 14 million tons in 4 years.

I mean, will you be confident, do you think, from the information that you have, knowing that we'll never know it all? Or, do you think it's much more likely that you will come back and say: Well, if we had another 10 years, we could be confident of that.

Mr. MAHONEY. With the one reservation that, of course, the final decision of balancing economic and environmental benefits and costs is a policy decision for the Congress and the Nation and not for the scientific community, with that reservation, our view and our intention with NAPAP is that we will come back and say: We have done the very best that anybody could ever hope to do.

And we will have that broadly reviewed by all of the scientific community who cares to comment. And we'll be ready to say: Here are the effects we see and their severity and, if this degree of control is intended or desired, this is what it would take to get there.

And we'll say what we can about uncertainties about it. I have to leave that one level of if-then question. The scientific community should not finally say: We think there should be ultimately the one level of protection or another.

But, as an example of what's in the plan, as we're developing it, we're undertaking the responsibility to provide the best possible scientific definition of severity of effects.

That's already in our briefing materials, and there are things in development now, so that we can do the best job we can of bringing the scientific information to the policy community.

Mr. SHARP. My 5 minutes are up, but if my colleagues would be willing to bear with the chairman, which they don't have a lot of choice on, I'd like to give our colleagues down the row—because I think the NAPAP program centers in this debate in very big ways—and give others a chance to comment on—I'm not asking for detailed criticism or support for the program—but the essential question of is it likely that we will have a new understanding that will help guide us 2 years from now, should we choose to wait.

Or, is it your view that, in fact, we'll be right where we are today. Dr. Friedman seemed to suggest that the caliber of what we will know is not likely to be substantially different. I don't mean to speak for Dr. Friedman, but I'd be glad to let others respond.

Dr. Galloway.

Mr. GALLOWAY. In my mind, there's three questions that you need to have answered. On any particular system, are they affected, why are they affected, and what can be done about it?

We would have to break it up into the waters and the soils, or the aquatic ecosystems and the terrestrial ecosystems. The aquatic ecosystems, we know they're affected.

I believe the literature supports my belief that we know what affects them, the increased deposition of sulfur. We know what would have to be done to protect them. My testimony would be to that.

I think we know that now. We'll know that a little bit better in 2 years, but not much.

For the terrestrial ecosystems, we know that some are affected. We know that some trees are growing slower.

We don't know why. There's a variety of causes that have been proposed: ozone, other oxidants, and sulfur dioxides, nitrogen oxides, drought, insects. It's probably everything together.

But we don't know exactly why they're being affected. In 2 years—I'm not a terrestrial ecologist, but I would venture to say we probably won't know exactly what the pollutants are or the natural causes that are making some species of trees grow slower.

But I will, of course, defer to Ellis Cowling, terrestrial ecologist.

Mr. SHARP. Dr. Cowling, do you want to respond?

Mr. COWLING. I think Jim is correct in his assessment that the forest damage issue is not going to be clarified in 2 years alone.

I think it's important to realize that, although the aquatic part of NAPAP began much earlier and was intensively pursued, the forest issues really didn't get started until about 1986. So, we're 2 years into those experiments, and we will have——

Jim and I have put together a summary of what we anticipate will be known by 1990. And I think among the things we'll know is we will have a much better understanding of the spruce fir situation, the extent to which ozone and/or acid deposition, particularly in cloud water form, is an important stress factor in that system.

I think the influences on productivity, as opposed to some trees suffering from some increased stress, is not going to be resolved in 2 years alone. And it's very, very important that we sustain the effort with the forest ecosystems, recognizing that we only got started in 1986.

Mr. SHARP. Sustain the scientific inquiry.

Mr. COWLING. Sustain the scientific inquiry beyond 1990 in forest systems. It's going to take more time for more than the spruce fir system to get reliable answers.

Mr. SHARP. I appreciate that. I didn't mean to imply that I thought NAPAP ends our desire to know. But rather the timetable of NAPAP shapes very much the debate on Capitol Hill as to whether it's worth waiting for it to complete, because does that tell us more, and both sides used that in their debate.

Mr. COWLING. Let me just add one other thing.

Mr. SHARP. Yes. Sure.

Mr. COWLING. It seems to me that fundamental to the uncertainties and difficulties we have in much of this array of presentations here is the issue of whether we're talking about acid rain alone or whether we're talking about pollutant influences in our society in general.

And I would say that the implication has come from many of us here that, if we could identify the resource values we are interested to protect, we can then focus the assessment more effectively.

If you want to know more about spruce fir, we could spend additional effort in being sure we're well prepared to deal with spruce fir. If you want to deal with maple declines, for example, that's another matter.

If we're satisfied to leave it at aquatic ecosystems, that's another matter. So, what are the resources?

Is visibility important to the people of America? Now, visibility is not a big part of NAPAP.

But I, for one, having helped bring NAPAP into being, hope that there's going to be a significant gain from that investment. I'm confident that there will be. I'll do what I can to be sure it's a substantial gain in new knowledge.

But the question of visibility is a good one. We know pretty much about that. It differs in different parts of our country. But is visibility on the public's mind?

Acid rain apparently is. So, we talk a lot about acid rain. Visibility would be influenced by decisions about acid rain.

So, should we then think about visibility more importantly in the NAPAP assessment? Or, should it be left less importantly.

And some guidance about such matters, I should think, would be valuable, not only to Jim but also to the rest of us who wish to make a contribution to being sure that the legacy of NAPAP is a very positive one in terms of science and in terms of a tradition of inter-agency and inter-university cooperative efforts in scientific inquiry.

Mr. SHARP. Thank you, Dr. Cowling.

Dr. Friedman, I put words in your mouth. So, I think you certainly ought to have the opportunity to——

Mr. FRIEDMAN. To clarify a little bit.

I think it is unreasonable to expect a consensus by 1990. If NAPAP does its job very well, you'll get a better understanding of the range of uncertainty, and you'll get a better understanding of the range of uncertainty that we——

Mr. Sharp. But will we be more uncertain?

Mr. Friedman. And that may be true.

And you'll get a better understanding of the range of uncertainty that we have now, I believe.

Dr. Mahoney has a tremendous job ahead of him, in 2 years, just to synthesize what we know today. Not the new information coming in, but just what we have on our plate right now.

I wish him the best of luck. I am sure we will be learning tremendous amounts from the NAPAP assessment, and we will be mining the NAPAP research for many years past 1990.

But, again, I think 1990 is a very short time to expect breakthroughs in scientific understanding.

Mr. Sharp. Dr. Hidy.

Mr. Hidy. I generally agree with what has been said. Dr. Mahoney is a very good friend of mine, and I have confidence in the leadership that he will give to NAPAP.

The single most important thing that should come out of the 1990 assessment is an integrated picture of the environmental risk and uncertainties of acid rain exposure, as we know it today and will know it in 1990.

This also needs to include something that was built into NAPAP originally, which was consciously deferred in the Interim Statement of the program, and that's an economic analysis of the implications of this particular phenomenon in relationship to many others that take place in the field of air pollution alone.

So, I think this is going to be very important information for you in terms of making a considered and careful value judgment about the kind of legislation that the country would be most comfortable with.

Mr. Sharp. Thank you very much. My time has more than expired. Let me recognize, in the order of appearance, Mr. Synar. The gentleman from Oklahoma is recognized for 5 minutes.

Mr. Synar. Thank you, Phil.

Dr. Cowling, the 1981 National Academy of Sciences report, which you helped initiate, included the following conclusion. Let me quote it.

> It is the committee's opinion, based on the evidence that we've examined, that the picture is disturbing enough to merit prompt tightening of restrictions on atmospheric emissions from fossil fuels and other large sources, such as metal smelters and cement manufacturers.

Has anything changed over the past 7 years to change your opinion?

Mr. Cowling. That is not an opinion which I participated in. I helped start that committee, but the committee ran itself after I got it started.

Mr. Synar. Do you disagree with that statement?

Mr. Cowling. I think they were a bit more urgent about it than our past experience——

Now, it's been 8 years, or 7, since that was written, and I think there was a greater sense of——

I think that's been alluded to in our discussions here, too. There were a bunch of worries for which we have gathered some evidence that indicates that things are a little slower. Things are not so urgently near a crashing point as they were thought to be.

So, in that sense, the sense of urgency that's portrayed in that statement, I think is more than history has now justified.

But, nevertheless, there are concerns. It isn't as though we don't have a problem.

Mr. SYNAR. Dr. Mahoney, from reading your testimony today, what you basically say is that the issue is whether or not we are going to make or act now or in 2 or 3 years, and that we are going to have basically better technical information available in those 2 or 3 years when you get your final assessment.

You know, my problem with that and the whole issue is the following. It's that administration officials have been saying, wait for a couple of years, for a long time. Let me give you a couple of examples.

In October 1981, EPA's Assistant Administrator for Air testified before the House subcommittee that NAPAP's policy recommendations on acid rain will be developed within 2 or 3 years; that is, 1983 and 1984.

Then, in February of 1982, EPA's Assistant Administrator for Air again testified before a Senate subcommittee that the uncertainties associated with acid rain will be reduced to the "next 3 to 5 years." That would be 1985 to 1987.

Now, you're here today and saying, we need 2 to 3 more years.

We've spent over $400 million. Now, Dr. Friedman in his testimony today says the following: "I expect that the scientific debate over the benefits of reducing emissions will still be vigorous in 1990 when NAPAP completes its assessment, and with as much disagreement as today."

When does this all end?

Mr. MAHONEY. First of all, Mr. Synar, I agree with the general observation that I think several on the panel have made, that we will never have certain information. We will continue to find challenges and problems in the years ahead.

But I don't think that is a prescription for being entirely open-ended. Let me respond more directly to your question in a couple of ways.

First of all, I am an employee of the Federal Government now, and clearly a representative of this administration, but I am not a political appointee. I am hired in a senior scientific position, and my personal measure of statement and credibility relates to the scientific community and my responsibility to my job.

I'm not here to represent a policy position, other than the very clear direction I have from my bosses, who are the policy leaders of the administration in this area, that we do the very best job we can getting the science out. So, I'm not here to represent a position about delay under the guise of more study.

On the specific issue of timing now versus later, the matter I've already spoken about, I think, is central. That is that we have never really integrated our information.

And, remember, we're talking not only about effects but about a selection of possible control measures. And you've heard here concern about whether to impose retrofit $SO_2$ controls, say, on existing facilities now, or within a few years be open to the use of certain clean coal technology.

It's that whole range of questions that have to be drawn together in the integrated assessment, as we'll be describing in the plan in the very near term here.

So, it's in that sense that I think we do have an important change in understanding coming by the very public and very structured process that NAPAP will be carrying out over the next couple of years.

Mr. SYNAR. Well, Dr. Mahoney, that's fine, and I appreciate that answer. You have read the Acid Precipitation Act of 1980, have you not?

Mr. MAHONEY. Yes, sir. I have.

Mr. SYNAR. You are familiar with the fact that it does require you all to conduct research on the causes and effects of acid rain, but, more importantly, to make recommendations to us the Congress and the President.

Have you made any recommendations to the President?

Mr. MAHONEY. I have not made any recommendations.

Mr. SYNAR. Have you made any recommendations to Lee Thomas, the head of EPA?

Mr. MAHONEY. I've not made recommendations as a basis for action. I make a number of recommendations in the sense of the status of our program right now, and I've made specific recommendations on——

Mr. SYNAR. On acid rain or just your program?

Mr. MAHONEY. No.

Mr. SYNAR. No recommendations on acid rain, right?

Mr. MAHONEY. The recommendation—yes, sir, I have. The recommendation I've had is that the appropriate——

Mr. SYNAR. On the control program.

Mr. MAHONEY. On the control program, in the sense that it is appropriate to wait for the information we are developing before embarking on specific choices on controls.

I have not made recommendations about the selection of one technology versus another or the like.

Mr. SYNAR. And you've made none to us, either. Right?

Mr. MAHONEY. That's correct.

Mr. SYNAR. So, we haven't gotten anything for our $400 million yet, with respect to recommendations on how to solve this problem. Have we?

Mr. MAHONEY. With respect to specific recommendations about control actions, no, sir. You have not.

Mr. SYNAR. Thank you, Mr. Chairman.

Mr. SHARP. The time of the gentleman has expired.

The gentleman from Washington, Mr. Swift, is recognized for 5 minutes.

Mr. SWIFT. First of all, I'd like to thank Dr. Friedman publicly for being very generous with his time with some of the staff. Some of us who have been working hard on both ozone and acid rain issues are appreciative of that technical support that you've given when we've asked.

A couple of questions. To follow on just briefly with this question of when do we know enough to act.

Someone argued that it's never bothered Congress before whether it knew anything, why should it now?

On the other hand, you can always avoid doing anything, arguing that you never know enough, because there's always more to know. Right?

I mean when you get all done with this—and none of you are suggesting you will then know everything that will ever be known about this topic scientifically.

Obviously, at some point, if we're going to act, we're going to have to act with some things unknown. Right?

That doesn't mean that we should run about and do stupid things. But do we know enough about acid rain to get started on it now?

Are there things that we know now we could do that would help with this problem? So that we wouldn't, when your report comes out, or 10 years from then, we probably would not find that we have done something dumb.

Is the state of scientific information such that we can get started?

I'd like to hear from all of you, in fact. Mr. Friedman, do you want to start?

Mr. FRIEDMAN. At least I will have to throw that back into this committee and others in the Congress's lap.

In our earlier assessment and certainly today we feel that we do know enough to take first steps to act if we so desire. That both sides are justifiable.

On one side, one group bears the benefit of the uncertainties. On the other——

Mr. SWIFT. I'm not trying to lure you people into making policy. I understand that. I understand.

What I am suggesting is, do we know enough about acid rain, its causes and its harmful effects, to be able to begin to put in place some controls which technically and scientifically you could get broad consensus will be effective in solving the problem?

And I am defining that as something we can get started with. But is that a sufficiently scientific question to ask you, that you can respond?

Do we know enough about its effects and its causes and its cures, if you will, to be able to get started to put some technologies in place to begin dealing with the problem, given the state of our knowledge today?

Dr. Hidy.

Mr. HIDY. Yes, sir. I would like to encourage you along those lines, that there are things that can indeed be done that are very positive measures.

And the first one is to push strongly for the approval of clean coal technology II. That's in your appropriations budget for 1989, at approximately $2 billion.

And I think in order to move forward with the kind of technology that this country needs, in using its coal base, that's a very important thing for you to consider.

Mr. SWIFT. I'd be happy to consider that.

But I'm saying—you know, what you're talking about is can we develop some clean coal technology.

Mr. HIDY. No. I'm not talking about development. I'm talking about demonstrating to them to be convinced of their reliability to be put in place.

Mr. SWIFT. Right. I support that. That's fine.

Mr. HIDY. And with that, legislation that can also be written in such a way that, if it's successful, it can be put into place.

The second point, I think—if I may, sir—is to suggest to you a program that is already in existence, which is demonstrating lake and stream lining to be very useful as an interim remediation measure for lakes and streams that have shown acidification for a variety of reasons.

Lining programs do exist. We know how to do them, and they certainly can be used as an intermediary to resolving this problem in one of the key areas of concern.

Mr. SWIFT. Do I understand, by your absence of suggesting there's anything we can do at the top of smokestacks, that you don't believe there's anything we can do at the top of smokestacks?

Mr. HIDY. No. I'm not suggesting that. I'm suggesting——

Mr. SWIFT. That we could do today, that we know would be effective and we know would be some help.

Mr. HIDY. No. There are emission control technologies that could be put into place if you choose that. But how much is the question.

And recognizing also that, if you put into place something now in terms of legislation, it likely will not take effect for 5 or 10 years.

Mr. SWIFT. What I'm getting at is we're trying to cut through this argument. You know. And it just seems to me that clearly we're doing some things now. Right? On this whole area. And is there more we can do that we know how to do that we should be putting in place now?

I'm perfectly willing to entertain the argument that there are some things that might be suggested in which there's insufficient scientific knowledge to know whether that's going to be effective.

I'm not talking about doing those. But we get the other part of the argument that says, well, you've just got to wait until 1990. And then you're going to wait until 1995. And then you're going to wait until the year 2000 before you do anything. Which is ridiculous, to suggest you can string this out forever.

I'm not asking you when is enough, enough. That's kind of our decision. I'm trying to get, and it seems to me it's a kind of a yes or no kind of a question.

Do we have a level of scientific knowledge about acid rain and what can be done about it that we can take some additional steps now, with some relative degree of certainty that those are going to be effective?

Mr. COWLING. I think there are. And I think one of the things that——

We give a lot of attention in the Government circles to regulatory policy. And an alternative is to educate the public so that it will make its own choices about the amounts of energy it uses for whatever purposes it does.

We've made major progress on energy conservation. Energy conservation and the increase in efficiency of electrical generation capacity are among the opportunities we have to decrease the emissions simply by using less energy.

We are a Nation devoted to abundant use of energy. All you have to do is compare how much energy we use with what other countries use.

If the public better understood, through an educational campaign, that all these effects, like visibility, which everybody can see who flies around in airplanes, is caused by the same substances that are released as the result of running your air conditioner when you don't need to or choosing how you drive your car or whether you use public transportation or your personal vehicle or how you maintain the emission controls on your personal vehicle, those are among the kinds of things that could make an immediate difference.

But it would require a campaign on the part of the Congress and leadership in the present administration to say energy conservation is a way that Americans should choose in the interest of improving air quality generally, including the health of our kids and the acidity of our lakes and the rejection of our forests and visibility, which is one of those things.

Incidentally, the point might be made that Jim is going to be issuing this plan, and the Congress could very well make its wishes known with regard to that plan. If you want visibility, for example, put into his planning, you could react to however much attention he proposes to give to that.

But I come back. Energy conservation is an immediate process which, if we had effective leadership, I believe could make a difference in emissions.

Mr. SHARP. The time of the gentleman has expired. Perhaps——

Mr. SWIFT. I'd ask unanimous consent for 2 additional minutes. I understand what the chairman is trying to do, but——

Mr. SHARP. Without objection.

Mr. SWIFT. I've been running around this roundhouse here, and I'm going to see if I can't find some way to stop. I get the distinct impression that I don't know enough to ask you the right questions.

It seems to me that I could get a yes or a no to my question. I'm hearing about conservation, for crying out loud, and I'm hearing about we're going out and liming lakes. You know that's not what I'm talking about.

Mr. Friedman, can I get a yes or no?

Mr. FRIEDMAN. I think we're all choking here on the how much. And you said we don't have to answer that.

I don't believe there's anyone sitting at the table who would say that, if you reduce sulfur emissions, you would do harm to natural ecosystems.

Mr. SWIFT. I will accept that, and yield back my time.

Mr. SHARP. I thought Dr. Galloway was trying to answer, too. He might give you more the answer you wanted. I shouldn't be promoting that.

Mr. SWIFT. All right. Dr. Galloway.

Mr. GALLOWAY. It will be very hard to follow the statement from my colleague on my left. But it does make me think that too many scientists have been accused of having two arms.

They say on one hand we believe this. On the other hand we believe this.

I'm going to put one hand on this chair arm and say: Yes, we do know in one area something about cause and effect. We do know that if you reduce sulfur deposition by an appropriate amount you would experience lake recovery both in chemical status and biological status in the timeframe of 10 years in the northeastern United States and southeastern Canada.

Mr. Swift. Thank you. I'm very touched.

Mr. Sharp. I'm glad we're not the only ones accused of right hand and left hand.

The gentleman from Illinois, Mr. Bruce, is recognized for 5 minutes.

Mr. Bruce. Mr. Mahoney, I'm just a small town, county seat lawyer.

Mr. Sharp. Watch out.

Mr. Bruce. Mr. Swift here and Mr. Synar have taken you guys on, but you didn't get a chance to answer the question, "What have you done with our $400 million?" What do you feel like you've accomplished with the expenditure of $400 million in your study so far?

Mr. Mahoney. First of all, Mr. Bruce, I'll try to describe that as an answer for all of the 7 years the studies have been going on. I've been in my position for a little less than 3 months, so when you say the "you," I hope you'll agree to my using the corporate "you" about the whole program.

The program has carried out major field studies related to aquatic effects. It has carried out, beginning at a later time, a very broad scale forest response program and that is still underway. It has examined—it has a large program in examining the effects of acidic deposition on materials. It has had a very large investment in the development of the science to complete a computer model which is a state-of-the-art, large scope effort to give us a proper understanding of what happens to these pollutants in the atmosphere.

This work has involved altogether more than 2,000 scientists working in the whole program at various times over these last 7 years.

The cost is very large, necessarily, because of the scope of work and questions undertaken. To give some example right now, there are nearly 300 current research projects underway in the program and it is all of that that we are trying to draw together to come back to the sense of the question that Mr. Swift asked here a couple of minutes ago—that is to say finally what can we say and what can't we out of all of that.

Mr. Bruce. When you get your study all done—you are about half way through, is that correct?

Mr. Mahoney. Well, I'd say maybe three-quarters.

Mr. Bruce. Three-quarters?

Mr. Mahoney. Three-quarters in the running of the studies. We're in what we think of as this pull-it-together and reporting phase. These last 2 years will go into this whole issue of making a single set of statements out of it all.

Mr. Bruce. And both Mr. Synar and Mr. Swift seem to indicate that they want a resolution. Do you believe that your report will be the definitive report on acid deposition? Will there be any report more thorough than the report that you will complete?

Mr. MAHONEY. I really believe it will be the most thorough. I believe it will be the most reviewed. My prepared statement, for example, mentions that there will be, along with all the other review, an independent scientific committee set up to give yet another level of oversight to it all. Our whole planning process and our reports over these 2 years of pulling this together will be subject to intensive review by any interested person as well as the scientific community, and in fact, Mr. Bruce, what we are setting out as a mark here is that we think the Nation has made an investment on this program larger than it ever has—larger than it has ever come to the scientific community about before.

We really want to show that it is worthwhile because as we go ahead in the decade of the 1990's there is a whole series of other questions that we are well aware of about global climate and toxic substances broadly for which the scientific community ought to give some good input and our view is that you all will feel more positive about that if we really produce something useful in this case. That is where we are coming from as scientists about this.

Mr. BRUCE. Mr. Mahoney, in my part of southern Illinois, we have two kinds of truths. We have the truth and revealed truth. Now will your report be the revealed truth or do you expect there still to be controversy over the question of acid rain when you are done?

Mr. MAHONEY. It will be the lower case, plain vanilla truth, I think, but I think it will be an honest effort to pull everything together and I think that the matter that it will have such broad review in the process that we are involved with so that everybody who wants to look at this is going to be commenting on it and helping with the structuring and the fact that it will be structured to try to do our very best job to answer exactly the kind of questions raised. What exactly are we trying to control, to what level, and how do we do it, and in the sense that we'll give our best answers to those tough questions it will be the best effort that I think a large group of people involved can make.

Mr. BRUCE. Mr. Swift evidenced some impatience with getting on with the results, whether or not we ought to just be taking a look at smokestacks.

Mr. Hidy indicated lake liming was being done—I think that's being done extensively in Sweden.

Mr. HIDY. That's correct.

Mr. BRUCE. And Dr. Cowling, you mentioned energy conservation. West Germany is doing forest fertilization. None of those programs, energy conservation we give some lip service to—are there any other programs that we could do immediately—what other things and how does NAPAP fit into that idea of doing energy conservation, lake liming, forest fertilization, the whole series of programs? What other things could we be doing immediately?

Mr. MAHONEY. First of all, NAPAP's mission is not operation or recommendations in that sense, so I don't have any program to offer directly like that, sir.

Mr. BRUCE. But the other members of the panel? Any other immediate things that we can do? That's it? Maybe we have exhausted the list. No one is going to say anything about oxygenated fuels or anything?

Mr. SWIFT. You're leading the witness.

Mr. BRUCE. I'm not leading him. Your Honor, I guess that slipped out.

Mr. SHARP. Don't you think ethanol would solve all these problems?

Mr. SWIFT. You're out of order.

Mr. COWLING. So far as effects on forests are concerned, we know for certain that ozone is causing damage to forests in America. Now we can undertake to decrease emissions leading to the formation of ozone and that would involve VOC and $NO_x$ simultaneously. Now the question that Mr. Swift raised I think is a function of something that goes on.

When we have an appreciable scientific—or an appreciable division of public opinion about something, we require a very high standard of scientific rigor. When we have a general consensus about matters, a relatively lower standard of scientific rigor is acceptable, and part of the concern, the intensity of debate is because we don't have a public consensus of what we ought to do with air quality in North America.

We are expected to meet very high standards of scientific rigor and that takes time and money to do. To the extent to which we could achieve significant improvements of the productivity of our forests by decreasing ozone is not known, but we can certainly say there will be some improvement in the health of our forests if we decrease the amount of ozone to which our forests are exposed.

We know how this controversy about to what extent and in what way the relative ratios of $NO_x$ and VOC, George Hidy can deal with that much more effectively than I can—but I believe we know how to get the ozone down in the important parts of our country.

Mr. BRUCE. Thank you, Mr. Chairman.

Mr. SHARP. Dr. Hidy, do you want to comment?

Mr. HIDY. Mr. Chairman, I think another comment here is in order. We always get into these arguments of the type Mr. Swift has introduced in some absolute context, and I think it is important to remember that this country's come a long way with respect to air pollution control since 1965 under the Clean Air Act, so a question for you is, in part, what can we do, but also taking into account what we have done. Is it enough at this time relative to other issues, or should we go further, and that is a very difficult policy question to make that science has not going to be very helpful on.

Mr. SHARP. The time of the gentleman has expired. The gentleman from Florida, Mr. Bilirakis, is recognized.

Mr. BILIRAKIS. Thank you, Mr. Chairman. I have an opening statement that I would ask be included in the record. [See p. 7.]

Mr. SHARP. Without objection—part of the record.

Mr. BILIRAKIS. Mr. Chairman, the subject of this hearing, if I may quote, an oversight hearing on what guidance, underline guidance, the scientific community can give to Congress on the issue of acid rain. We have heard an awful lot of comments here and I guess recommendations. I am not sure we really got too many of those. Certainly what we received, I guess, is the range of uncertainty, to use somebody's terms. It seems like there never will be a consensus, even though science is supposedly an exact type of thing.

In 1981, the National Academy of Sciences' report recommended a 50 percent reduction in hydrogen ion deposition, not a 50 percent reduction in $SO_2$ emissions. Dr. Mahoney in the conclusions of the interim study suggests that the current acid deposition levels are not expected to increase and that they will not produce an abrupt change in aquatic systems, crops or forests. Dr. Gallagher—Dr. Galloway, I beg your pardon, sir—tells us that we can expect continuing acidification, but he doesn't know the percentage—I am not sure how we know that we can expect continuing and have had continuing acidification if we don't know the percentage, at least in rough.

In Congress we are charged with the responsibility to make decisions, to make a pretty darn tough decision on the basis of a range of uncertainty.

I would ask the panel a specific set of questions dealing with Florida, if you will. I am an American and I am concerned with the entire country and certainly with our neighbor, Canada, but my number one concern has to be Florida.

The EPA has conducted a study on the acidification of streams. As you know, the draft report indicated that a large percentage of streams in Florida were acidic. This preliminary finding followed a static study of lakes in Florida which also indicated substantial acidification. Now, to what extent could natural conditions, and I know you've seen this argument made, to what extent could natural conditions such as pine needle runoff account for acidification? To what extent might an inability of lake and stream beds to buffer and neutralize acid be responsible? To what extent would we say that acidification is due to "acid rain," sulfur dioxide?

Dr. Mahoney, I might ask you before you respond to the question, you indicated earlier that you have been in your current position 3 months?

Mr. MAHONEY. Yes, sir.

Mr. BILIRAKIS. Were you a member of NAPAP or an employee of NAPAP prior to that?

Mr. MAHONEY. No, sir, I was not, but I was an appointee of the President on the oversight task force that has oversight relative to NAPAP.

Mr. BILIRAKIS. Well, even though there have been some disagreements here, the impression that I get from the rest of the panel is there's a large amount of credibility in NAPAP and the job that you and the Agency are performing, but that's something we all should keep in mind.

Well, I would ask you to respond to my questions if you could.

Mr. MAHONEY. In the case of the Florida data, let me give a reserved response, because I don't want to mislead in an area where the questions you ask have a fairly technical, specific response too. We'd be glad to provide further about that but let me say overall, yes, natural, organic material can be responsible for substantial acidic effects and we expect that to be the case for at least part of Florida. We don't have a good view about cause and effect in the case of some of the Florida data at this time. That is still under study, but we do recognize that natural material can be a major contributor and likely is in at least some case.

Mr. BILIRAKIS. And likely is.

Any other comments? Dr. Cowling.

Mr. COWLING. I think Jim that Jim Galloway is better able to answer this than I, but the distinction between the clear water lakes of Florida and the brown water lakes of Florida is a very important one, and the humic acids that give the lakes the brown color is a very different situation than the clear water lakes, but I expect that Jim is in a better position to answer your specific question.

Mr. BILIRAKIS. Dr. Galloway.

Mr. GALLOWAY. I'd like to say two things. First of all, I have not seen the report that EPA has released. I probably read the same article in the New York Times that you read. However, both gentlemen are correct. You can have natural and anthropogenic acidification of lakes. It certainly happens in Florida. As Ellis Cowling has said, for clear water lakes there are—a primary source of acidity for those lakes is atmospheric deposition of sulfur and nitrogen compounds. It is based on what I know about the atmospheric deposition of sulfur. It is not surprising to find that there are low alkalinity lakes in Florida that have been acidified by that deposition. As to the number and the degree of acidification, I would have to see the data to make any other statement about that.

Mr. BILIRAKIS. Well, could you tell us, sir, would emission limits contained in H.R. 2666 produce any appreciable effect on such high levels of acidification?

Mr. GALLOWAY. You'll have to brief me on what those emission limits are and what the geographical spread of the——

Mr. BILIRAKIS. Well, the ranges that we talk about here, I guess what—10, 12 million tons? Less—8, 9, 10?

Mr. GALLOWAY. It certainly would not hurt. They would certainly not get more acidic. I know that is not the answer that you want, but——

Mr. BILIRAKIS. I am not particularly looking for an answer, the way Mr. Swift was. I honestly would like to know some answers.

Mr. GALLOWAY. Well, let me say it this way. If those controls reduce sulfur deposition in Florida, then yes, those lakes would recover.

Mr. BILIRAKIS. Do you agree, Dr. Cowling? You are shaking your head.

Mr. COWLING. The reason I am saying that, and I am also sympathetic with Jim's concern, is where did the 8 million tons come from? If they came in Texas or they came in Alabama or they came in Minnesota or they came in Maine it would make quite a difference the extent to which Florida's lakes would respond, and the Tennessee Valley Authority, for example, has committed itself to a 1.1 million ton a year decrease in $SO_2$ emissions alone by 1992. That is going to help and if there were more commitments that close to Florida, it will help.

Mr. BILIRAKIS. Good point. Now I would ask, and it has been acknowledged certainly by Dr. Mahoney and I'd say the rest of you that streams and lakes in Florida are naturally acidic—I guess we don't know to what degree yet, but they are naturally acidic. Is that correct?

Mr. Galloway. Some.

Mr. Bilirakis. Some. All right. That being the case, what level reduction in acidity is advisable? I mean, there is a particular point where we are never going to reduce acidity further because of the natural factors?

Mr. Galloway. That's correct. That is why it is so important to differentiate between brown water lakes, which are naturally acidic due to organic acids—you mentioned pine needle runoff—or the clear water lakes, of which you can eliminate pine needle runoff or other organic acid types as a source of acidification—cause of acidification.

For those clear water lakes, if you increase the pH of the lake above 5.3, 5.5, then you are getting in the range where biological populations can begin to experience some degree of normalcy.

I'd like to have a follow-on, if I may, to a point you raised earlier, a bit of a perceived conflict in the testimony between Jim the First and Jim the Second.

You were making comments about changes in the northeastern United States and southeastern Canada relative to relatively constant levels of sulfur deposition. You are also making some comments about the scientific process. I would like to use the latter to respond to the former.

The scientific process involves creating a hypothesis or coming up with a theory and then going out and making observations—in this case, the environment—to test that theory. The theory states that you can continue to have acidification of streams and lakes with constant sulfur deposition because of acidification of the soil reservoir. The theory also states that biological populations will respond slowly to changes in chemical composition of reservoirs, and so once you decrease—once you make constant sulfur deposition you can have continued acidification and continued increase in biological effects.

Now observations are supposed to test the theory. We have several places where observations have shown for the lakes and systems that they have studied that with constant sulfur deposition you have acidification of these systems and delays in the biological impacts.

Now the reason we can't say how many is that only a few observations have been made, but those observations support the theory, which lends credibility to the theory to say that it can be applied to wider variety—a larger population of lakes.

Mr. Bilirakis. But in specific test areas you can tell us the percentage increase in acidification?

Mr. Galloway. Yes. For those systems that have been studied, that's correct.

Mr. Bilirakis. And yet still that disagrees with the conclusions made by NAPAP in terms of continuing acidification?

Mr. Galloway. I am not sure it does.

Mr. Bilirakis. You're not? It doesn't?

Mr. Mahoney. Well, if you'd like, I'll respond and see if Dr. Galloway——

Mr. Bilirakis. We do have a vote.

Mr. MAHONEY. I would just say that NAPAP's conclusion about the Northeast dealt with the regional pattern and the conclusion was that the data suggests that the regional pattern is approximately constant, but it specifically recognizes that individual systems can change as a matter of fact and I don't believe we are really in disagreement about that point. It is important to look at individual systems.

If I can for just an instant, sir, in answering further, responding to your question about what change would be beneficial in the Florida lakes or streams, that is exactly the kind of core question that we are trying to put in this integrated assessment process, because now that we have a lot of hypotheses and field measurements, what we are trying to do in a couple of years is to lay down all these things, of course in a massive structure at the detail level, but get it together, ask those questions, have them reviewed by the scientists involved and others who want to look at it, prepare the answers and have those answers reviewed too, because there is all this uncertainty and then finally bring all that back into some fairly simple conclusions.

Mr. BILIRAKIS. Are you telling me—I'm going to say this very quickly before the chairman stops, but are you telling the Congress that we should hold off on any reduction of $SO_2$ emissions for the time being until those couple of years are up? Are you suggesting that to the Congress?

Mr. MAHONEY. Suggesting it insofar as the Congress wants to base any decisions about control on the information which has been developed over these years.

Mr. SHARP. The time of the gentleman has expired. I'll tell my colleague from Alabama if he wishes just a few moments now, we'll finally take it. Otherwise, we are going to break and come back after the vote.

Mr. CALLAHAN. Thank you, Mr. Chairman. We might as well go ahead and finish, but let me just ask permission to submit questions to the panelists and ask that they respond and that that be made part of the record.

Mr. SHARP. Certainly.

Mr. CALLAHAN. I've sat through two of these hearings, Mr. Chairman, as co-chairman of the forestry caucus, we're very interested in acid rain legislation. Here today I've seen no conclusive indication from either hearing that there is a need for a legislative remedy. It's very difficult to get straightforward answers and that is not disrespectful, it's just complicated answers that you give us.

There is one remedy we have not sought but I intend to begin that process maybe this weekend and save us a lot of time, and I think I'll consult with my astrologer. And possibly she can give me some indication as to whether or not there is a necessity to introduce or support any legislation with regard to acid rain this year.

Mr. SHARP. I appreciate the gentleman's remarks. I just hope we won't get sexist about astrologers. There are male as well as female astrologers.

Mr. CALLAHAN. That's my astrologer.

Mr. SHARP. I see. We are going to have to rush over to vote. We would like to take a break. We are going to excuse Dr. Hidy. If our other witnesses are willing to stay, we will try to close out by 4:30, so that people can make airplanes and other things.

Thank you very much. We'll take a break.

[Brief recess.]

Mr. SHARP. The committee will please come back to order.

First of all, the Chair has some questions that we will submit from Mr. Swift, who wishes to have those answered, and Mr. Synar, as well. And I believe Mr. Bruce is making a telephone call and will be here momentarily.

Let's see if I can find my train of thought again after these disruptions.

Let me go back to one thing that keeps coming back up, you know, the tons and timing question, and see if I can just get any indication of certainties or uncertainties out of you.

I guess the place to start is with what I understand to be the position of Mr. Galloway that, if we would make a 50 percent reduction, we would see recovery in about 10 years of most of the aquatic systems, the ones that he identified as being damaged by manmade acidity, what we put up in the air.

Is that level something that others would identify as a way to define the goal for us? What kind of certainty arises around the 50 percent mark as the level to be achieved?

And a collateral question is: Suppose we make the value judgment or the critical judgment here that, given the uncertainties that we hear and the costs that we hear, we decide collectively—not everybody here would agree to that, but we won't go that far—but is there another useful level?

In other words, is this the kind of thing which every ton that we reduce is viewed as a positive, or is this the kind of thing where, if we don't really reach 8 to 10 million tons or 14 million tons, we better just defer the question? It isn't worth investing the time and the political capital and the economic capital to do it?

Dr. Galloway, why don't I let you, first, if I haven't stated it correctly, restate or assess that, and then see if I can get others to comment on their comfort level with that proposition.

Mr. GALLOWAY. I'll be glad to respond. You asked a series of questions and, if I leave one out, you let me know. I'm sure you will.

First of all, my statement said 50 percent reduction in deposition. And then I mentioned that that requires reduction in emissions, but how much reduction in emissions is dependent on where those reductions occur.

Mr. SHARP. Oh. I see. I'm sorry. It's the deposition level you're talking about.

Mr. GALLOWAY. That's right. The deposition level.

OK. You have the whole dynamic of emissions relative to going up in the air and where they come down. But depositions at 50 percent.

The next general question you had was whether that was something that I had come up with by picking it out of the air, so to speak, or is that something that's generally accepted.

I took that number from a review from a recent workshop that was held on this specific issue of critical loads. And, at that time, the scientists who had been working in the area concluded that on the order of 10 kilograms of sulfur per hectare per year was an acceptable loading.

Now, I said that's 50 percent reduction, because of the emissions in this part of the world.

In another part of the world, Scandinavia and Europe, it wouldn't be 50 percent. But the number of 10 kilograms of sulfur per hectare per year is the accepted load.

The uncertainty about that number is 10 plus or minus 5 kilograms of sulfur per hectare per year.

So, if you wanted to target eastern North America for that reduction, you would have to go to the people who know about emissions versus transport and transformation in the atmosphere, and say: I want to receive 10 kilograms of sulfur per hectare per year in New England, say. Where would you have to reduce that? Where would you have to reduce sulfur emissions?

Dr. Mahoney has mentioned that there is a model being worked on, the regional acid deposition model, which is to provide that link between what goes up in the air and when it comes down.

That's the extent of my memory on your questions, and, if you have a——

Mr. SHARP. I'm having trouble myself.

Are there others that would care to comment on that 50 percent figure as to whether they think other scientists would agree with that 50 percent deposition reduction?

First of all, with the statement that the 10 kilograms per hectare is a legitimate, reasonable standard to seek to achieve for what's happening.

Mr. GALLOWAY. That's total sulfur deposition. We have to be very careful with units, because some of the critical load units are kilograms of wet sulfates, sulfate wet deposited. Some are kilograms of sulfur of wet only.

What I'm talking about is kilograms of total sulfur, wet deposition plus dry deposition.

Mr. SHARP. But, obviously, when you work that back, some of the legislative proposals claim they're going to make a 50 percent reduction. And, if I understand, the language of their promotion of those is based upon a takeoff from the kind of thing you have just said.

Mr. GALLOWAY. That's correct.

Mr. SHARP. But, if I understand what you've also said about this, that link is not what is as well established. In other words, that it's the tracing back from what's on the ground here to here. The response may not be simply to reduce sulfur emissions. Or, am I wrong about that?

Mr. GALLOWAY. Well, if you are targeting a lake in the Adirondacks or a stream in Virginia to experience that deposition, I think any atmospheric scientist would be hard pressed to say exactly at what plants you should reduce that sulfur.

If you're targeting eastern United States or, more correctly, eastern North America, then it would be very correct to reduce emissions across the scale of eastern United States and eastern North America.

And on those scales, it's generally accepted that there is a linearity in the relationships between the emissions and depositions.

Mr. SHARP. Gross linearity between the things.

Mr. GALLOWAY. That's right.

Mr. SHARP. It's just the more narrow range.

Mr. GALLOWAY. That's right. I think Ellis referred to that in his verbal testimony.

Mr. SHARP. Yes, Dr. Mahoney.

Mr. MAHONEY. Mr. Sharp, if I can, I think it's good to elaborate or extend those views somewhat.

I agree with Dr. Galloway in large part, but it's very easy to have a couple of matters taken more strictly than they should be.

For example, I can't agree with the concept that there is a gross linearity over the large region. I can agree with it as a scientific concept, but not as one which would say: Well, if we think we ought to have half as much deposition or a 50 percent reduction in deposition, the right thing to do about that is let's just get a 50 percent reduction in emissions over-all and we'll find that.

And, if we're not very cautious about that, we will, I think, have a misunderstanding there.

I would trace the same chain of questions that you've just been putting slightly differently.

First of all, there is a natural deposition, as we've all agreed, that's much smaller than the man-made causes in the eastern North America. No one disagrees about that. And, in an ideal world, we go all the way back to that, but we can't.

So, the relevant question is: What level would we want to get down to if we want to have fewer effects than we see now? And the debate has focused around numbers, as Dr. Galloway has indicated. But don't forget the plus or minus 5, and don't forget that different watersheds can have different effects and the like.

All of that sometimes has got to be reduced down. And that's what we are trying to do when we deliver our NAPAP reports, to say what exactly are we trying to achieve on that part of the problem.

But, remember, the statement is also that the changes seen in the chemistry and in the biological systems have been gradual in large part. What that means—I'm not saying that they're not important. What it means is that, if we had one level of reduction, a level somewhat different would have a slightly different effect.

We don't see, generally, points where all of a sudden a little bit more reduction causes much improvement. It tends to go along a scale. And, as a result of that, we have to bring our ideas back to—we have to cut somewhere to make recommendations in time.

So, that kind of recommendation that you're hearing about here, we in the scientific community, I think, would like to get it on the table, get it spread out as written ideas, have it reviewed by everybody who wants to pay attention to it, and then start developing our strategies around that.

For example, the strategy about where to control, finally, is not, as I think everybody would agree, as simple as just: Give me an X percent reduction desired, and the best thing to do is to go out and get X percent emission reductions everywhere.

And that whole thing's complicated at least one more step by the matter of timing that we've been talking about. Because, if we said: Well, we know it would be better to do it sooner, but, if doing it sooner means we don't get certain other emissions reductions, like we don't get nitrogen emission reductions that we might want for other reasons, that's not a good choice.

In that sense—and I'm sort of summarizing—the thing we'd like to get out of our integrated report in the next couple of years is some solid recommendations about how to get the best benefit for whatever level of investment is made.

It's not simply what reductions have we got to get. But, if as a Nation we do invest in it, it will be all of our resources and funds that pay for this. The scientific community ought to be doing all it can to make sure we get the most benefit for it.

Mr. SHARP. And you expect your report to be able to give us over the next 2 years a recommendation on what would be the best investment to make for our money. In other words, you'll be able to give us some alternative parameters as to what we might do.

Mr. MAHONEY. Yes, sir. Since you've added that part, I can say simply yes.

If you had said, the best, I'd have to say: Well, we'll give you different scenarios. Because there are all the value judgments.

But, yes, we do intend to lay out the broad parameters that would give the best resolution of the various effects we're talking about. Taking account, as has come up here, that we have an ozone problem as well as an acid deposition problem, and we need to consider how to apply technology to both of those, instead of marching ahead on one alone and then having to go back again on the other one.

Mr. SHARP. If I could ask Dr. Cowling to also comment on that, then I will let my colleague from Illinois speak.

Did, in the National Academy of Sciences, in any of those report, did they indicate that, as a target, it ought to be 50 percent or give any kind of basis on which we might draw the conclusion that it ought to be a 50 percent reduction in the emissions?

Mr. COWLING. I think, if we could talk in terms of the deposition, we're safer. That's where the science is on the strongest grounds.

We're struggling with an interface between science and political decision-making, and one of the things that could be extremely helpful to us in science is to know what are the ecosystem values that you want protected.

Do you want clear water lakes in Florida protected? Is it sufficient to do something about Canada, or should we ignore Canada in our decision-making? Are the Adirondack lakes a matter of concern to the Congress? Are the streams in western North Carolina among the things that we should be anxious to propose some alternative scenarios about in the effort within NAPAP?

The more that the Congress says: This is a value that we treasure and, please, in NAPAP do something that would give us guidance about that. To that extent, we can focus our attention much more effectively.

Mr. SHARP. You've gotten at the heart of what true politics is all about, and that is defining the public values, and the extraordinary difficulty we have in any society of getting folks to identify that, because some segments of the population put so much higher value on certain things.

Also, sometimes their value judgments are affected clearly by whether they gain or lose on the economic scale, as well, because they put a high value on that. Some do and some don't. It would be nice if more of us were able to set that value in context, but it's awfully hard for people to do that.

The difficulty is, of course, that too often we forget that that's what we're really doing in politics, is trying to determine those values. And the hope is that there's somebody out there who magically can tell us what those values are, and that you folks can absolutely define what they are.

But there does seem to me to come a point at which the science clearly triggers our value concerns that are latent or not well articulated or defined. And, in a sense, that's what we're trying to derive from you folks, is to say: We're not very knowledgeable about what's going on out there in the lakes and streams and whatnot. And we hear that we ought to be, because over 30 or 40 years we can really do some things that, when we wake up, it will offend our values.

So, what I guess we're asking you is to help us see whether or not what you are able to study and know should trigger our concerns about those things. Or whether we're just being hyped up by somebody who wishes all the streams were clean, which is a nice wish, but somebody doesn't have to worry about paying the bill.

Mr. COWLING. I think politicians are very cognizant of the variety of public opinions that they must meet.

Mr. SHARP. And the change.

Mr. COWLING. Oh, yes, the changing times. So, they're not stable. There's variety in there not stable in time.

Mr. SHARP. They change much more rapidly than the ecosystems, let me tell you.

Mr. COWLING. That may be true. But there's also a great population of trees——

Mr. SHARP. But the values don't necessarily. Excuse me for seizing on this.

I mean there are some longer-term values, if they get articulated and defined in a public debate, which I think people care about. I think they do care about public health and the environment.

What we come back to you to say is: How much should we be caring at the moment? Are we being foolish and stupid by not making the decision? Or, are we being wiser? We've got limited resources and we'll use them better if we'll just have a little more patience?

Mr. COWLING. Well, it's the understanding and the characterization of that very ability. For example, white pines are known to be sensitive to ozone, but it is some very sensitive pines that show conspicuous symptoms.

There's another population of white pines that are rather moderate, or even substantially resistant, and that's among the values.

The hyper-sensitive ones we may have already eliminated substantially. We were left with a substantial diversity. Is that diversity sufficient? That's a matter of public judgment and debate.

But the more we talk about these matters—what are the values? Do we wish to develop an environmental ethic in our political ways of doing things in this country? Is that something the people want in the next decade or so?

And, if we knew more about that and if we knew what manifestations that environmental ethic ought to take, then we in science can devote our energies to the better definition of the response functions that would give guidance about what kinds of protection or changes of emissions patterns would be desirable.

Mr. SHARP. I personally believe there's a very strong environmental ethic. I think how it's focused is what is unclear, and that keeps changing.

I need to let my poor colleague, who has waited patiently, have a chance. Our colleague from Tennessee has been very concerned about this issue, and extremely patient.

I saw you were out of the room, or I wouldn't even have recognized myself. The gentleman from Tennessee is recognized.

## STATEMENT OF HON. JIM COOPER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TENNESSEE

Mr. COOPER. I appreciate the chairman filibustering on my behalf. I also appreciate the chairman allowing me to sit in on this subcommittee hearing, since I'm not formally a member of this subcommittee, although I'm extremely interested in the subject matter.

Hearing the panelists, it seems to me that it's relatively evenly divided between those panelists who think that Congress needs more information and those panelists who think Congress needs more courage. I would be the first to admit that we need a little more of both.

I'm very sorry that Mr. Hidy is not here, because he was going to be the particular focus of my remarks. He may have been wiser than he knew to leave early.

In searching for a common denominator among the panelists, it seems to me that Dr. Friedman's humorous understatement was amusing but not quite accurate, when he said, I believe, that no one claims on the panel that decreased sulfur emissions would hurt anything.

It seems to me that there's a common denominator that's much more positive and much more active than that, and I thought it was best expressed in the statement, really repeated twice in Mr. Hidy's testimony, that says, let me quote: "In summary, a decision to undertake a national emissions control strategy should be approached in terms of taking prudent restrictive measures for environmental protection as an, quote, insurance policy, unquote, for the future."

To me, that's a pretty good common denominator, because even Mr. Hidy was willing to admit that as an insurance policy there's no harm in taking prudent restrictive measures right now. I think that is what my colleague Mr. Swift was driving at with some of his comments.

To me, that's a very important, significant statement. And my purpose here is not to make any invidious comparisons, but it is my impression that Mr. Hidy's institute, whatever EPRI stands for, is heavily funded by electric utilities. And electric utilities contribute to the vast majority of the sulfur dioxide problem that we've got in this country.

It seems to me, therefore, that Mr. Hidy's statement is particularly significant, because in other sorts of disputes that we see in Congress we don't often see a willingness of an industry-related institute to admit any problem at all, and they're loathe to recommend any action whatsoever, even an insurance policy type action.

So, to me, Mr. Hidy's statement was almost as remarkable as the Tobacco Institute admitting that cigarettes could cause cancer. Which they still haven't done yet to my knowledge.

So, I wanted to congratulate Mr. Hidy, but also to point out that, with that sort of positive common denominator, we in Congress should be willing to consider and debate and vote on positive steps to meet that insurance policy sort of approach—nothing prohibitively expensive, nothing radical, but moderate, modest steps that could be taken today so that we don't lose any more time.

There's one particular I want to explore: the cost of delay, the extent to which failure to achieve early emissions reductions accumulates and ends up having a further deleterious effect on our environment. Because, in my opinion, even the NAPAP study with its 10 year time horizon—and I hope that work is not expanding to fill the time and money given to it.

That 10 year delay, how damaging has that been, the decade of the 1980's, devoted to looking at the problem? Would any of you gentlemen care to make a statement about that?

And my follow-up question will be: How damaging is the delay at the other end? I believe only Mr. Friedman has addressed the question when he said, the difference between 1998 and 2003 is basically negligible.

How damaging is the delay, both at the front end of the process and at the rear end of the process? Mr. Mahoney.

Mr. MAHONEY. Mr. Cooper, if I can make a reference to Political Science 101.

Only, in deference to the chairman, I would comment first that I frequently reflect on the circumstance that, approximately 10 years after broad public recognition of acid rain concerns and more than 10 years in the case of many in the scientific community, the issue is not resolved.

That tells me that there are, in fact, strong competing real interests that cause us to reflect over that period.

For example, if the actual measured effects seen over the period of the 1980's, the period the studies have been going on, had been so profound, my personal view is that the Congress would have acted sometime much earlier, because they would have seen the smoking gun or whatever. They would have just taken action earlier on.

On the other hand, if the measurements to date showed problems, but nothing that captured the broad attention sufficiently, this probably wouldn't be on the front pages at all. It would be a special issue for some people, but it wouldn't be a major matter.

It's a remarkable matter that 10 years after recognition it is still is in front of us and is not resolved. And that is a measure of the challenge and the difficulty that we're dealing with.

The specific question of costs about this, I think, where we stand now, the issue is very much in front of you. No one denies, on this panel certainly, that there are deposition effects and that those deserve attention. I'm trying to avoid any words about could, should, specifically as to what level.

And the issue is now making sure that any commitments ever undertaken for specific action are efficient and effective and that they don't get in the way of other actions or they aren't counterproductive as to matters we might want to undertake in the future.

We remember the long-term picture is that much of the concern about sulfur oxide emissions will go away in time as the existing generation of facilities are phased out over the next 20 and 30 years.

So, the real tough question, along with everything else, is how much to invest and how much of the public wealth to spend on the issue of fixing up facilities that are in their middle and late lifetime.

Mr. COOPER. I think you're hitting on the real point there, because all it would take, in my opinion, given the 5 to 10 year lead time, should we impose anything legislatively, is another 10 year NAPAP study, and it would be too late. The plants you were affixing technology to would be dead plants.

And we're already, as you point out, in the mid to late life cycle of these plants. Speed has an extra meaning, it seems to me, in that context. Especially when certain utilities, as Dr. Cowling was very gracious to point out, like the Tennessee Valley Authority, where I'm from, were willing to go ahead and assume this burden early on.

To me, there's been a dramatic difference in approach among American utilities, and I think those who face the problem early and wisely, as it turns out, deserve some credit for that.

Dr. Cowling.

Mr. COWLING. I'd just like to mention again the fact that that was a decision made in the absence of a regulatory requirement, and at the expense of the ratepayers.

Although every time I've brought up this question of energy conservation, I think it's significant that part of the Tennessee Valley Authority's capacity to deliver on its intention to decrease emissions is going to be achieved by energy conservation.

And they have an organized plan of eliminating inefficient refrigerators, just to take one thing, and inefficient motors. Those are energy conservation approaches.

The Tennessee Valley Authority is making an educational campaign within the Tennessee Valley to educate people about getting rid of old motors. I mean, that's not a very complicated thing, but it works. It reduces the energy demand. Therefore, it reduces emissions, and, therefore, we get conservation.

I'm biased. I'm an educator. I believe that the American people would respond to a clear definition of educational goals where these issues are at hand. And there are things that you, me, everyone of us in this room could do to diminish our demands on the energy budget of our country.

Mr. COOPER. The TVA gets very little praise nowadays. I'm very thankful for——

Mr. Sharp. Would the gentleman yield?

Mr. Cooper. Yes, sir.

Mr. Sharp. I just wanted to indicate that, in fact, we are planning a panel on the contribution that conservation can make to this, as well as a panel on clean coal technology, what contribution it potentially can make.

And I share your view that there's a whale of a lot that can be done and at least some have done on conservation.

Regrettably there are some folks in the utility industry that have still got their heads in the sand of 10 and 15 and 20 years ago, who can't seem to get out of the notion that they have any responsibility to help get the consumer more efficient and rather love to build plants and——

Mr. Cooper. Mr. Chairman, if I could ask one further general question.

Mr. Sharp. Certainly.

Mr. Cooper. In my research into this issue, it seems to me that there are two fundamental approaches, should we decide to try to control emissions. You can have a rate approach and look at 1.2. Or, you can have a tonnage approach, which is actually my preference.

It seems to me, and I would like to get your reaction to it, that if you rely exclusively on a rate approach, you are losing the accumulative reduction effect that I think most of us are looking for. You allow more clean plants to be built, and we're thankful that they're clean, but it increases total emissions.

Whereas, if you take a tonnage approach and look at reducing the absolute level of emissions by a certain amount, you are controlling the limits of the damage. And, to me, this second tonnage approach is more effective, and is a little bit tougher, but should be the preferred approach. I'd like to get your reactions to that, if anyone would like to comment.

No takers.

Mr. Friedman. It becomes an exercise in acid rain numbers. OTA has analyzed many, many bills over the last 6 years, and either approach, depending upon the specifics approach, can come up with a whole range of eventual emissions reductions. By some year, 2020 or 2030, emissions will be at a given level.

If someone can say: I would like emissions to be at approximately this level, certainly then the tonnage approach has greater certainty to it. The rate approach has some other equity attributes and some other reasons why many find it to be attractive.

But you can reach your eventual target by either approach.

Mr. Cooper. Any other comments?

Mr. Cowling. I was just going to say that I remember one of the vice presidents of Inco, the International Nickel Corporation, saying: Tell us what the target is, and let us contribute to the definition of the processes by which we can achieve that target.

I think that's a very sensible thing, and that's what I had in mind when I wrote here: cooperation, consultation, and statesmanship.

And I was thinking of David Friedman when I wrote: Statesmanship is likely to produce more economically and scientifically sound management plans than legislatively-mandated solutions.

I would say of either sort, if the target is known and an appeal is made to responsible business leaders to take their responsibilities seriously, how many more David Friedmans are there out there who would make a difference in the total emissions by virtue of their own dedication to a target which was mutually agreed was desirable, whether forced by regulation or encouraged by education?

Mr. COOPER. Thank you, Mr. Chairman. I appreciate your indulgence.

Mr. SHARP. The gentleman from Illinois is recognized, another patient member here.

Mr. BRUCE. Let's get back to air transport. The 1983 NAS study said that, as far as they could find, there wasn't a currently validated model accurate enough to predict and attribute the deposition in one region as originating in another.

Is there anything that's changed since 1983? I understood that you're working on a model. Other than the work that you're doing on a model, has anybody else got a better model than what you're preparing?

Mr. MAHONEY. There are two broad-scale models currently in development and testing.

One is the one sponsored by NAPAP and developed by EPA and NOAH scientists and contractors working for them. The second one is a model very similar in its scope being developed under the sponsorship of the Canadian Government with joint help from the West German Government.

Both of these models are in a full-blown state now, and are being tested with field measurements. In fact, a very large-scale field program begins right away, within the next couple of weeks.

It will be going on over this summer and next spring, and the resources for that field program are so large that the work is being jointly sponsored by the Canadians, the West Germans, ourselves, and, in fact, Dr. Hidy's institution, the Electric Power Research Institute.

Mr. BRUCE. This is a joint model? Or, do you have a model and they have a model, the Canadians have a model with West Germany?

Mr. MAHONEY. There's a Canadian-West German model, and there's an American model. That's correct.

Mr. BRUCE. And you're going to start field testing them this summer?

Mr. MAHONEY. This summer.

Mr. BRUCE. And when will the results of the field tests be available?

Mr. MAHONEY. Beginning late this year and through next year.

Mr. BRUCE. And what, if anything, are they likely to tell us?

Mr. MAHONEY. The most important matters that we're trying to learn from the models are, in my view, two questions.

One, the geographic distance over which we see the major effects from sources, both individual sources and the source regions that we study. How far does the material in the atmosphere have to go before the acidic compounds develop and get deposited? That's kind of a bottom line question for that.

Second is the question of linearity. We've heard about linearity in different ways, the idea that what goes up has to come down. But it makes a big difference as to where it comes down.

For example, we do know right now that the summertime condition is one that produces a much higher rate of acid formation than the wintertime. Profoundly. About 40 percent.

If we had equal conditions, we'd have 25 percent of all the deposition in each of the four seasons. Instead, we have about 40 percent in the summer season.

And, in line with Mr. Cooper's question, by the way, a tonnage approach might be one that would look for ways to preferentially reduce emissions in the summer as far as total loading is concerned, by scheduling maintenance then, by using hydro or gas or other things in cases where that might be suitable.

But these are the kinds of issues that we will analyze with the model. Where material is deposited finally and the special atmospheric chemistry questions, how much acid material is produced at various times of the year.

Mr. Bruce. Is it possible that the model that the Canadians put together will show that we're the problem and our model will show that the Canadians are the problem?

Mr. Mahoney. No, sir. I really don't——

Mr. Bruce. I mean that seriously.

Mr. Mahoney. I understand.

Mr. Bruce. I mean that, with them having a model and us having a model, that we're both going to get into this same thing with all of you here, that each model is going to prove something different.

Mr. Mahoney. I don't think so, broadly. I think this is a case where there is a very beneficial joint effort underway. It's a case of some good science being done, I think. And I think the broad view of the scientific community is that both of these efforts are absolutely first rate.

In fact, these models, either or both of them, will be used probably by countries all over the world to look at the same matters.

And the fact that we've got such joint field evaluation going on, that we've had continuous meetings and exchange of scientific data between the two groups and the investigators all work very closely together, this is not a case where we're going to get a classic shooting match.

The broad patterns are pretty well known, but the questions of the effectiveness of what controls where is what we're trying to sort out.

But, no, I don't think we'll have what you asked. There's no chance, in my view, that we would see a result which would be that each side now blames the other side.

There will be differences, and that's the benefit of the independent development. But I think those differences will be more focused on some of the specific technical matters.

Mr. Bruce. Can I just ask you one more question about your model? Is it based on collection of data throughout the United States that you've fed into a computer, or is it a computer model where you have put in figures and air currents and velocities and get a theoretical viewpoint of where it would most likely land? What is the underlying data system on which the model operates?

Mr. MAHONEY. The data system is the real world data for the United States as broadly as we could get it. That's emissions data, the sources, and then the meteorological data, too, and that's all used. Specifically, from the Weather Service observations and the like.

The big benefit of doing this, of course, is that, once you have the emissions data for the current condition and test that out, then we can look at the patterns of emissions.

The whole reason for doing this, and getting it tested and then running it, is to say, OK, now let's do the what-ifs scenarios and let's look at the next 10 and 20 years with various types of control options and see how much difference in the deposition that all makes.

That's what we're doing, and trying to translate those deposition changes back to how much control or improvement we'll see in the water systems and the forests and the like at the end of the process.

Mr. BRUCE. Just one final question on this. The Electric Power Research Institute and the EPA tried to assist the Canadians in assessing the problems they had with acid lakes in helping develop their study. They refused any assistance.

What is the extent of cooperation between our Government, NAPAP, and every one in working with the Canadians on their model, along with the West Germans?

Mr. MAHONEY. I think it is excellent. There are, if I remember correctly, literally six different committees, dealing with the individual parts of the whole model development and evaluation exercise, that are in place, that are bilateral committees. They've had a whole series of meetings.

I certainly don't want to come here and claim that the existence of committees is the only measure of progress. But the point is that I think there is truly a very good working relationship among all the key people.

Mr. BRUCE. Thank you, Mr. Chairman.

Mr. SHARP. Thank you. Does my colleague from Tennessee have another question or two?

We'll try to wrap this up. I apologize to our panel. We gave you 4:30 and we're running past. But I'll let my colleague from Tennessee have a shot unless you need to dash out.

Mr. COOPER. One question. I was under the impression that the Black Forest in Germany experienced sudden degradation as a result of long-accumulated pollution.

Do you gentlemen have any evidence that things will proceed along relatively calmly and, then, all of a sudden, once you reach a certain level of pollution, that there could be sudden, very harmful damage to the environment? Is there any evidence of that?

Because I think it has kind of been assumed in our discussion that everything is gradual. Is there any evidence that changes in the environment are not gradual?

Mr. COWLING. Well, the German case is an exception to our generalization. I think my expectation is that it will be gradual.

In fact, now that we have become more conscious of what's going on in Germany and in other countries of central Europe, there are signs that were there which were not discerned earlier which do indicate stress in the forests.

And the decline of rate of radial growth, for example, generally precedes by about 15 years the appearance of visible symptoms. So that the signs were there, but were not read, even by German foresters.

Mr. COOPER. Thanks, Mr. Chairman.

Mr. SHARP. Gentlemen, we certainly appreciate your time and attention to this this afternoon. I know, on many occasions and whatnot, you've gotten to listen to each other and others, undoubtedly.

But it was very helpful to us, and we certainly appreciate your cooperation for this lengthy affair this afternoon.

Thank you very much.

[Whereupon, the subcommittee adjourned, to reconvene at the call of the Chair.]

[The following responses to subcommittee questions were received:]

EPRI
Electric Power
Research Institute

July 29, 1988

The Hon. Philip R. Sharp
Chairman
U.S. House of Representatives
Committee on Energy and Commerce
Subcommittee on Energy and Power
Washington, D.C. 20515

Re: Response to Supplemental Questions - Acid Rain Hearing, May 26, 1988

Dear Mr. Sharp:

This letter replies to your request of July 22th to answer certain additional questions from Mr. Swift, following the acid rain hearing May 26th. Mr. Swift's questions address the issue of ecological resources at risk to acid deposition exposure in the western states. I have reviewed these kinds of questions some time ago, and the supporting material for my answers are in the attached reports.

The answers are provided below:

1. As I understand it, in the West we have many lakes with relatively low buffering capacity, so that they would be sensitive to damage from acid deposition. Is that correct?

   Using a measure of low acid neutralizing capacity (ANC), there are a number of lakes and streams in the western U.S. that are potentially sensitive to acid deposition. These are generally found in alpine areas of the Rockies, Sierra Nevada, Cascade and Olympic mountain ranges.

2. What does current scientific evidence tell us about any present level of damage to these lakes as a result of acid deposition, and the potential for future damage?

   Surveys and historic observations to date indicate that there is no scientifically supportable evidence that any western surface waters have been acidified by atmospheric deposition. Based on scientific analyses of the watershed characteristics of a few lakes in California, Colorado and Wyoming, for example, none show any permanent change in acidity, nor would any be expected at current deposition rates of sulfuric or nitric acid. There has been at least one report of temporary (lasting less than a month) acidification response to acidic snow melt and a thunderstorm containing strong acidity (in California and Colorado).

3. What does current scientific evidence tell us about any current level of damage to other resources in the West as a result of acid deposition, and the potential for future damage?

    There is no evidence of any forest or crop damage attributable to acid deposition per se in rural areas of the West at current deposition levels. There are some historic data on forest and crop damage very near large $SO_2$ sources, such as smelters or power plants emitting much higher concentrations than presently found in practice.

    It is well known that ozone exposure effects have been observed on conifers (namely Ponderosa pine) and certain crops in southern California. Ozone is sometimes found as a co-pollutant of acid in the air.

    There is no confirmed evidence of human health effects of acid deposition in the West, although some have been speculated on as "acid fog" concentrations in the Los Angeles area.

    Some damage to paint coatings, metal surfaces and architectural material have been reported in western cities, as suggested elsewhere. The economic significance of such damage is uncertain, but is considered to be a minor factor in replacement costs. There may be effects on archeological ruins, but no studies have been reported on this question.

    Visibility (an air quality related value) impairment in parts of the West has been attributed to elevated sulfate concentrations in the air. It should be noted that western visibility conditions are generally far superior to those found in the East because of regional acid conditions and much lower pollution levels.

4. To what extent would a policy of limiting our growth in emission levels, as opposed to reducing current emission levels, be adequate to protect Western lakes and other Western resources?

    Emission levels of $SO_2$ in the West have decreased dramatically in recent years, partly due to pollution controls and partly from the closing of several large non-ferrous smelters. Emissions of $NO_x$ have tended to be steady or slightly on the rise in the West, but sources are generally confined to cities and to highly isolated power sources (e.g., power plants). A policy of limiting growth in emission levels would presumably focus on $NO_x$, and be superfluous for $SO_2$ in the West. In any case, an emission limitation policy of both gases at present levels would serve to protect western aquatic and terrestrial ecosystems virtually in all areas with sensitive resources. Reductions in $SO_2$ and $NO_x$ seem unnecessary in the West with present very low regional sulfate and nitrate levels. Some have recommended $NO_x$ reductions to improve urban air in the West, and to influence ozone levels. In the latter application, one must be careful about $NO_x$ control as a means to reduce ozone because of important non-linear chemical processes that may lead to locally higher ozone levels, depending on volatile hydrocarbons to $NO_x$ concentration ratios.

5. Do you have any suggestions for what kinds of emission limitations, and of what pollutants, we should be looking at in order to protect Western lakes and other Western resources?

   I believe that emission limitations of $SO_2$ and $NO_x$ at current levels (or even somewhat higher) will provide for adequate (regional) protection of western resources susceptible to acid deposition -- because acid deposition rates are very low in the West. Emission limitations near sources or cities should be considered on a case-by-case basis under the current provisions of the Clean Air Act to protect humans and the environment.

Sincerely,

George M. Hidy
Vice President and Director
Environment Division

GMH:jh
enclosures

NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM

722 JACKSON PLACE, N W
WASHINGTON, D.C 20503
202/395-5771

September 1, 1988

The Honorable Philip R. Sharp
Chairman, Subcommittee on Energy and Power
Committee on Energy and Commerce
U.S. House of Representative
Washington, D.C. 20515

Dear Mr. Chairman:

On behalf of the National Acid Precipitation Assessment Program (NAPAP), I am pleased to respond to your letter of July 11, conveying the questions of Representative Swift pertaining to the effects of acid deposition in the western United States. I appreciate the consideration of Representative Swift and yourself in agreeing to our request for an extension of the response date until today.

The attached response incorporates the views of staff in this office as well as several NAPAP Task Group Leaders, and various other scientists with research interests in the West.

NAPAP is currently developing a comprehensive plan for its Integrated Assessment. The Assessment Plan details the specific questions being addressed by NAPAP in its reports to be issued in 1989 and 1990, indicates the information to be employed in answering these questions, and forecasts the level of scientific confidence to be assigned to the various answers. The Assessment Plan will be released for public review in the early October.

I hope that you will have the opportunity to evaluate the scope of NAPAP's planned analysis of acid deposition causes, effects, and control strategy options. I would be pleased to provide a briefing on the plan for you or your staff, as soon as it is completed.

I hope these answers respond to your current information needs. If you have any other questions or comments, please feel free to call me.

Sincerely,

James R Mahoney

James R. Mahoney
Director

Attachment

cc: The Honorable Al Swift
The Honorable John D. Dingell

## RESPONSES TO QUESTIONS OF REPRESENTATIVE AL SWIFT
## PREPARED BY
## THE NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM

SEPTEMBER 1, 1988

Question #1: "As I understand it, in the West we have many lakes with relatively low buffering capacity, so that they would be sensitive to damage from acid deposition. Is that correct?"

Answer: There are many lakes with low buffering capacity in the western United States. In 1985 EPA conducted a random sample of more than 1000 western lakes in regions thought to be potentially sensitive to acidic deposition, based on available data. Sensitivity to acidification is often inferred from measurements of acid neutralizing capacity (ANC) with the following interpretation:

| | | |
|---|---|---|
| ANC less than zero | -- | Acidic water |
| ANC less than 50 ueq/L | -- | Generally agreed to be very sensitive to acidification |
| ANC less than 100 ueq/L | -- | Generally agreed to be sensitive to acidification |
| ANC greater than 200 ueq/L | -- | Generally agreed not to be sensitive to acidification |

Findings from EPA's Western Lake Survey (WLS) indicated that no western lakes have ANC less than zero[1], approximately seventeen percent have ANC less than 50 ueq/L, approximately forty-three percent have ANC less than 100 ueq/L, and approximately thirty-four percent have ANC greater than 200 ueq/L.

Low ANC is only one condition necessary for surface waters to be regarded as sensitive to acidification. Associated watershed characteristics such as sulfate retention, base cation exchange capacity, and hydrology must also be considered when characterizing the sensitivity of surface waters.

Results of the Western Lake Survey, including analyses of regional variability in ANC patterns, are available in the EPA Report, "Characteristics of Lakes in the Western United States - Volume I: Population Descriptions and Physico-Chemical Relationships." Report Number: EPA-600/3-86-054a (1987).

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[1] One lake out of more than 1000 sampled exhibited ANC less than zero. However, this was a special case caused by a naturally acid hot spring, rather than acidic deposition.

Question #2: "What does current scientific evidence tell us about any present level of damage to these lakes as a result of acid deposition, and the potential for future damage?"

Answer: No acidic lakes (i.e., lakes having an ANC of less than zero) were found in the Western Lake Survey. Moreover, over 99 percent of western lakes had pH levels greater than 6.0. However, little knowledge about possible damage resulting from episodic pH depressions is available. Periods of temporary pH depression have been documented in conjunction with spring snowmelt and summer storm activity, but the potential for damage resulting from these episodic phenomena is highly uncertain. This is the subject of ongoing research.

With respect to the potential for future acid-related lake damage, the very dilute lakes in the West would be expected to respond rapidly to any change in watershed input. Little change in the chemistry of lakes in the West is expected to occur if deposition levels remain constant. Episodic damage may be possible, but we have little evidence upon which to base an estimate, particularly in the West. If $SO_2$ and/or $NO_x$ emissions were to increase, then the potential for some damage — especially near large emission sources — would increase.

Question #3: "What does current scientific evidence tell us about any current level of damage to other resources in the West as a result of acid deposition, and the potential for future damage?"

Answer: Forest damage in parts of southern and central California is caused by ozone exposure, and perhaps exacerbated by highly acidic, nitrate dominated, fogs. There is no scientific evidence of damage to forest resources in the West as a direct result of acidic deposition. NAPAP is conducting studies in the Rocky Mountains, the Northwest, and in southern California to continue assessments of the sensitivity of tree and crop species to the combined effects of acidic deposition and other pollutants.

Other NAPAP studies have focused on the potential for pollutant-related degradation of materials and cultural artifacts. In the West these studies have been carried out at the sandstone ruins in Mesa Verde National Park in southern Colorado. Three years of monitoring studies conducted by National Park Service scientists indicate very low deposition and erosion rates. However, if acidic deposition increases, it would result in an increase in materials degradation. The magnitude of such an incremental change in degradation is unknown.

Visual range is reduced in the western United States as a result of air pollution. Studies have shown that fluctuations in $SO_2$ emissions from smelters in the Southwest have been associated with changes in visibility. The National Park Service has operated visibility monitoring equipment in remote sites during the past ten years. These observations indicate no apparent long-term increase or decrease in visibility.

If $SO_2$ or $NO_x$ emissions were to increase significantly, then the potential for damage — especially near large emission sources — would increase.

**Question #4:** "To what extent would a policy of limiting our growth in emissions levels, as opposed to reducing current emissions levels, be adequate to protect western lakes and other resources?"

Answer: We have no evidence to argue that emissions reductions are necessary to protect western lakes and other resources from potential damages associated with acidic deposition. Current regulatory mechanisms, such as the new source performance standards (NSPS) and the requirements for the prevention of significant deterioration (PSD) of air quality, provide important protection to western resources. However, available scientific information is not adequate to fully assess the potential for future damage resulting from emission increases in the range allowed under these regulations.

**Question #5:** "Do you have any suggestions for what kinds of emissions limitations, and of what pollutants, we should be looking at in order to protect western lakes and other western resources?"

Answer: Existing regulations, especially the NSPS and PSD requirements, provide significant protection to the non-urban western regions from damage due to new sources of acidic deposition. Current impacts of acidic deposition on western resources appear to be small to negligible, especially when compared to ozone impacts. No damage to aquatic resources was found in the Western Lake Survey. Observed forest damage is limited to south and central California and is linked to ozone and perhaps other oxidants. Acidic deposition, especially related to nitrogen compound emissions in Southern California, may exacerbate this damage, but no research results are available to confirm this.

# ACID RAIN OVERSIGHT

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## WEDNESDAY, JUNE 15, 1988

House of Representatives,
Committee on Energy and Commerce,
Subcommittee on Energy and Power,
*Washington, DC.*

The subcommittee met, pursuant to notice, at 9:43 a.m., in room 2322, Rayburn House Office Building, Hon. Philip R. Sharp (chairman) presiding.

Mr. Sharp. The subcommittee will please come to order. Today is the second of four scheduled oversight hearings on acid rain. Our first hearing sought the wisdom of the scientific community. The scientists were very helpful in giving the subcommittee a sense of where research has led us so far.

They told, for example, that acid rain has been definitely implicated in the acidification of certain lakes and in damaging materials. They also told us, however, that current levels of acid rain do not cause crop damage and that the role of acid rain in forest damage is yet unknown. Other pollutants, including ozone and its precursors, definitely play a role in crop damage and may be implicated in forest damage.

In addition, and perhaps most important, the scientists emphasize that there are no magic numbers to guide us; no magic formula for the number of tons of reduction and the date by which these reductions must be accomplished. They agree that reductions in sulfur emissions are beneficial, but they gave us no immutable answers about what we have to do and when. We in Congress are the ones who have to decide what to do about acid rain.

This second hearing explores the role that electricity conservation might play in an emissions reduction program. As in our hearing of several weeks ago, we are not addressing any particular piece of legislation, but if there is a common thread to the various bills that have been introduced during the past three Congresses, it is the staggering costs. Those of us in the Midwest who would be most heavily hit by the various proposals have, of necessity, looked for ways to soften the blow.

Energy conservation shows considerable promise. If for example, a State or Federal law directs a utility to cut its sulfur emissions by 25 percent, we could accomplish the reductions in various ways. For example, we could install scrubbers or other technology on the plant. We could switch to low sulfur coal, or we could attempt to reduce electricity use.

Indeed, a major study by one of today's witnesses concludes that in the ECAR region of the country, which includes Indiana and

Ohio, an aggressive conversation program could reduce $SO_2$ emissions by 7–11 percent during the 1990's and could reduce expenditures for scrubbers and low sulfur coal by 25 percent and more. When viewed in the context of a multi-billion dollar program, this is an offer difficult to refuse.

Our question today, however, is can we solve the substantial technical, administrative and regulatory problems associated with an electricity conservation strategy? That is among the questions that we will want to offer and ask our witnesses today.

Other subcommittee members will be present shortly. There unfortunately is a caucus in the full House of Representatives that had not been scheduled when we scheduled this. Our senior ranking member, Mr. Moorhead, has an opening statement that we will include in the record at this point.

[The opening statement of Mr. Moorhead follows:]

### OPENING STATEMENT OF HON. CARLOS J. MOORHEAD

Thank you, Mr. Chairman. It is a pleasure to be here at this second day of oversight hearings on the issue of acid rain. Today's topic, energy conservation, is an issue that the subcommittee has addressed separately, but rarely in the context of acid rain controls. I commend the chairman for bringing these two important issues together.

At today's hearing, we are likely to hear divergent viewpoints on the appropriate role of energy conservation in acid rain policy. Some of the debate will be reminiscent of debates this subcommittee has had over research and development in conservation. Some will argue that we can, and should, be doing much more at the Federal level to encourage conservation. Others will respond that the benefits of conservation have been overestimated and that the marketplace should determine the appropriate level of conservation.

In this debate, one point on which we all can agree is the need to avoid unnecessary barriers to conservation. Too often we in Congress fail to predict accurately the full effect of legislative initiatives. In many instances, we find out only much later that a law or proposed regulation had unintended consequences. Today's hearing will provide us with an excellent opportunity to ensure that the legislation we enact to reduce acid rain emissions will not discourage conservation. Conservation efforts are one of the few tools available that can respond to both an energy and an environmental problem.

I look forward, Mr. Chairman, to hearing from today's witnesses. I hope that they will be able to identify for us the kinds of measures that would restrict the positive use of conservation to reduce acid rain emissions. Thank you.

Mr. SHARP. We now welcome our panel of witnesses. We're pleased to have with us Mr. Howard Geller, with the American Council for an Energy-Efficient Economy; Mr. Roger Sant, chairman of the board of the Environmental and Energy Study Institute; Mr. Eugene Trisko, executive vice president with Stern Brothers, Incorporated; the Honorable David Moskovitz, Commissioner with the Maine Public Utilities Commission, and Mr. John T. Prendergast, Energy Manager for the LTV Steel Company.

Gentlemen, if you'll please come forward, we'll be happy to hear your testimony. I believe you are all familiar with our processes here. We will be happy to make your written statements a part of our printed record and we would be delighted to have at this time the oral summary of your testimony. Mr. Geller, we'll be happy to begin with you.

## STATEMENTS OF HOWARD S. GELLER, AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY; ROGER W. SANT, CHAIRMAN OF THE BOARD, ENVIRONMENTAL AND ENERGY STUDY INSTITUTE; EUGENE E. TRISKO, EXECUTIVE VICE PRESIDENT, STERN BROS., INC.; DAVID MOSKOVITZ, COMMISSIONER, MAINE PUBLIC UTILITIES COMMISSION; AND JON T. PRENDERGAST, ENERGY MANAGER, LTV STEEL

Mr. Geller. Thank you, Mr. Chairman. The American Council for an Energy-Efficient Economy is a non-profit organization which gathers, evaluates and disseminates information to stimulate greater energy efficiency. ACEEE has extensively analyzed the role that electricity conservation can play in cutting acid rain emissions and offsetting costs of further emissions controls. Our findings are reported in the study that you noted in your opening remarks.

Our study shows that aggressive electricity conservation offers a way around the problem of acid rain cleanup costs. First, cutting electricity consumption through the purchase and use of more efficient motors, appliances, lighting products, controls systems and the like, will lead to less coal use and a direct reduction in sulfur dioxide emissions.

Second, aggressive conservation can provide large economic savings from deferring the construction of new power plants over the long run. These economic savings can more than offset the costs of other emissions controls that are needed. Let me provide a few of the details.

For the ECAR region which you had previously noted, consisting of Ohio, Indiana, Michigan, Kentucky, West Virginia and small parts of Maryland and Pennsylvania, we identified cost effective electricity conservation measures that could cut electricity demand in the region by 15 percent in the year 2005 relative to the current utility forecasts. It's a fairly modest reduction in the load growth from about nearly 2 percent per year to around 1 percent per year.

As you stated, this could result in a cut in $SO_2$ emissions in the region from about 7-11 percent throughout the 1990's, which of course, is not nearly enough to comply with the various acid rain cleanup proposals, but it certainly does help, especially since the emissions reductions from conservation can be used to displace the most expensive pollution controls.

The potential economic benefits from conservation are perhaps more significant than the direct environmental impacts. Conservation will hold down electricity bills and defer the need for constructing new power plants in the region during the 1990's. This would save utilities billions of dollars, enabling them to undertake further acid rain cleanup without overly burdening their consumers.

We found that consumers in the Midwest could realize a net savings of $4–$8 billion if emissions control and accelerated conservation both occur, compared to a scenario where neither occur. By the way, realizing environmental an economic benefits from conservation does not require special utility operating procedures such as environmental dispatch which means cutting back on the use of the dirtiest power plants in response to load reductions.

Because of this opportunity for cutting acid rain emission without economic hardship, we believe it is critical that acid rain legislation provide States and utilities with full credit for emissions reductions achieved through conservation. Not all legislative proposals for acid rain control accomplish this. In particular, statewide average emission rate limits do not provide full credit for conservation-induced emission reductions and could even discourage conservation.

If lower electricity demand results in reduced utilization or early retirement of plants with below average emissions rates, then the utility or State will move away from its rate limit goal. Even though conservation is reducing absolute emissions, a utility or State will be penalized. This perverse result is likely to occur in practice, since cleaner plants are likely to be more expensive to run and are the first to be cut back as utilities dispatch their power plants.

Another legislative approach places emissions rates limits on individual power plants, either in a specified year, or when the plants reach a certain age. This approach will not provide credits for lowered emissions when conservation leads to reduced power plant operation, because the plant's emissions rate is not effected by the amount of operation.

Statewide emissions ceilings on the other hand, provide full credit for all emissions reductions due to conservation and other approaches to pollution control. This approach is flexible and equitable and the utility or State advances towards its ceiling the same amount by cutting emissions one ton, regardless of whether its due to lower electricity demand, use of cleaner fuel, cleaner generating technologies, or use of flue gas scrubbers.

Consequently, we urge the subcommittee and other Federal policy makers to use statewide emissions ceilings as the method of legislating reductions and acid rain emissions. Our recommendations are echoed in a number of other studies, some of which I think will be covered by other speakers.

One concern with the emissions ceiling concept is that it places a cap on economic growth, or that it penalizes States and regions with above average economic growth. However, economic growth is in no way constrained by statewide $SO_2$ emissions ceilings. Rapid economic growth provides additional opportunities for electricity conservation, because it is more feasible and economical to implement conservation in new factories, homes or office buildings.

States such as California have demonstrated that lower than average growth in electricity demand can be accomplished, despite higher than average economic growth. Second, numerous technologies and approaches for cutting $SO_2$ emissions are already available and others are under development. States and utilities can plan and implement a combination control approaches for cleaning up acid rain to reach their emissions ceiling as the need arises.

In the past, economic growth has not prevented emissions ceilings or firm limits on pollutant concentrations from being adopted to control a wide range of pollutants. This is the approach in the National Ambient Air Quality Standards and also it's the approach in the recent protocol for control chlorofluorocarbon emissions to protect the ozone layer. Each country in that case has a production or emissions' ceiling to protect the ozone layer.

Regarding acid rain control, Canada has adopted provincial emissions ceilings to implement a 50 percent cut in $SO_2$ emissions in Canada. Emissions ceilings are the most straightforward and perhaps the only way to adequately safeguard the environment which of course, does not increase its tolerance for acid deposition in step with economic growth.

To conclude, let me just mention a couple of the other provisions for Federal acid rain legislation that we urge in order to encourage conservation. First, some States are given subsidies for acid rain cleanup. Investments and conservation measures should qualify as emissions reductions expenditures. They should be eligible for the subsidies.

Second, acid rain legislation should direct States to consider end-use efficiency improvements and to strive for least cost energy services, not necessarily minimum electricity costs when they develop their acid rain compliance plans. Electricity conservation can plan a major role in a national acid rain cleanup strategy. Whether or not States and utilities have a strong incentive to conserve, depends on the approach taken in acid rain legislation.

Let me stop here and thank you for allowing me to speak and I'll be happy to elaborate in the question and answer period.

[The prepared statement of Mr. Geller follows:]

TESTIMONY OF:

HOWARD S. GELLER, ASSOCIATE DIRECTOR
AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY
WASHINGTON, DC

The American Council for an Energy-Efficient Economy (ACEEE) is a non-profit organization which gathers, evaluates and disseminates information to stimulate greater energy efficiency. ACEEE has extensively analyzed the role that electricity conservation can play in cutting acid rain emissions and offsetting the costs of further emissions controls. Also, we have reviewed the different legislative proposals for acid rain control as to their compatibility with and encouragement of electricity conservation. Our findings are reported in a study titled Acid Rain and Electricity Conservation, released last summer.

## Potential Benefits from Accelerated Conservation

Acid rain is costing our nation many billions of dollars each year through damage to forests, lakes, croplands, materials, etc. And each year, new studies show more evidence of damage. Sulfur dioxide is the primary source of acid rain in most regions. Technological fixes for reducing sulfur dioxide emissions are readily available. But utilities that are heavily dependent on high-sulfur coal, many of them in the Midwest, are resisting these fixes. A major problem is cost -- installing flue gas scrubbers or switching to cleaner coal to reduce emissions will increase the cost of generating power, which in turn could lead to higher electricity bills.

Our study shows that aggressive electricity conservation offers a way around the problem of acid rain clean-up costs. First, cutting electricity consumption through the purchase and use of more efficient motors, appliances, lighting products, control systems, and the like will lead to less coal use and a direct reduction in sulfur dioxide emissions. Second, aggressive conservation can provide large economic savings from deferring the construction of new power plants over the long run. These economic savings can more than offset the cost of other emissions controls that are needed. In other words, by pursuing conservation and emissions control together, utilities and consumers can save money.

Let me provide a few of the details. Our research pertains to the ECAR power pool region which consists of Ohio, Indiana, Michigan, Kentucky, West Virginia, and small parts of Maryland and Pennsylvania. This region is very dependent on high-sulfur coal; it emits about 33% of utility-generated SO2 in the U.S. We identified cost-effective, widely available electricity conservation measures that could cut electricity demand in the region in 2005 by about 15% relative to utility forecasts. (This implies a reduction in load growth from 1.7%/yr to 0.9%/yr). The conservation measures do not reduce amenities or economic output. And the degree of electricity savings in our accelerated conservation scenario has been achieved or is expected in the future in regions of the country that are actively pursuing conservation.

Implementing this amount of conservation in the ECAR region would cut SO2 emissions by 7-11% during 1992-2002. It would also cut emissions of NOx, another source of acid rain, carbon dioxide, and other pollutants. A 7-11% reduction in SO2 emissions is not nearly enough to comply with the various acid rain clean-up proposals, but it does help especially since the emissions reductions from conservation can be used to displace the most expensive conventional controls.

The potential economic benefits from conservation are perhaps more significant than the direct environmental impacts. By reducing electricity use and load growth, implementing conservation measures will hold down electricity bills and defer the need for constructing new power plants in the ECAR region during the 1990s. This would save utilities billions of dollars, enabling them to undertake further acid rain clean-up without overly burdening their consumers. In other words, utilities could better afford to buy scrubbers or clean coal with the money they save by not having to build as many new power plants. In fact, we found that consumers in the Midwest could realize a net savings of $4-8 billion if emissions control and accelerated conservation both occur compared to a scenario where neither occur. This net savings accounts for expenditures on conservation measures as well as electricity and pollution control.

Realizing environmental and economic benefits from conservation does not require special utility operating procedures such as environmental dispatch (i.e., cutting back the use of the dirtiest power plants in response to load reductions from conservation). In fact, we found that utility costs in the ECAR region are minimized when normal dispatch procedures are maintained. For example, it is not cost effective to use conservation to reduce the use of existing dirty power plants if this leads to more or quicker construction of new capacity.

## Conservation and Acid Rain Legislation

Because of this opportunity for cutting acid rain emissions without economic hardship, we believe it is critical that acid rain legislation provide states and utilities with full credit for emissions reductions achieved through electricity conservation. In addition, federal legislation should encourage states and utilities to pursue conservation in conjunction with pollution clean-up. Not all legislative proposals for acid rain control do this.

In particular, statewide average emissions rate limits (i.e., limits on pounds of sulfur dioxide emitted per million Btu of fuel burned) do not provide full credit for conservation-induced emissions reductions, and could even discourage conservation. If lower electricity demand results in reduced utilization or early retirment of plants with below average emissions rates, then a utility or state will move away from its rate limit goal. Even though conservation is reducing absolute emissions, a utility or state will be penalized. This perverse situation is likely to occur in practice since cleaner plants are often more expensive to run and are the first to be cut back as utilities dispatch their power plants. And even when conservation reduces the use of power plants with above average emissions rates, less credit is received under a statewide average emissions rate limit than under a total emissions ceiling.

Another legislative approach places emissions rate limits on individual power plants either in a specified year or when plants reach a certain age. This approach will not provide credit for lower emissions when conservation leads to reduced power plant operation because the plant's emissions rate is not affected by the amount of operation. If the emissions rate limit is stringent enough, a flue gas scrubber has to be added if the plant continues to operate. Conservation could be used to "mothball" or even retire dirty power plants, but this will not be economical if it accelerates construction of expensive new generating capacity.

Statewide emissions ceilings, on the other hand, provide full credit for all emissions reductions due to conservation. This approach is flexible and equitable -- a utility or state advances towards its ceiling the same amount by cutting emissions one ton, regardless of whether it's due to lower electricity demand, use of cleaner fuel, cleaner generating technologies, or use of flue gas scrubber. Consequently, we urge the Subcommittee and other federal policymakers to use statewide emissions ceilings as the method for legislating reductions in acid rain emissions. Our recommendation is echoed in other studies, such as Strategies for Reducing the Cost of Acid Rain Controls (Environmental and Energy Study Institute, January 1988) and Acid Rain: Road to a Middleground Solution (Center for Clean Air Policy, July 1987).

One concern with the emissions ceiling concept is that it places a cap on economic growth or, similarly, that it penalizes states and regions with above-average economic growth. However, economic growth is in no way constrained by statewide SO2 emissions ceilings. First, rapid economic growth provides additional opportunities for electricity conservation because it is more feasible and economical to implement conservation in new factories, homes, office buildings, etc. States such as

California have demonstrated lower-than-averge growth in electricity demand despite higher-than-average economic growth. Greater opportunities for electricity conservation (and thus some emissions reductions) could help more rapidly growing states to comply with SO2 emissions ceilings.

Second, numerous technologies and approaches for cutting SO2 emissions are already available, and others are under development. States and utilities can plan and implement a combination of scrubber retrofits, fuel switching, greater end-use efficiency, and cleaner generating technologies as the need arises. Careful planning can eliminate or minimize the net cost related to acid rain control no matter how rapidly local economies are expanding.

In the past, economic growth has not prevented emissions ceilings or firm limits on pollutant concentrations from being adopted to control a wide range of pollutants. For example, this approach is used in the National Ambient Air Quality Standards and in the international protocol for controling chlorofluorocarbon emissions in order to protect the ozone layer. Also, Canada has adopted provincial emissions ceilings to implement a 50% cut in SO2 emissions. Emissions ceilings are the most straightforward and perhaps the only way to adequately safeguard the environment, which of course does not increase its tolerance for acid deposition in step with economic growth.

Another issue pertaining to the treatment of conservation in acid rain legislation concerns the need to specify emissions reductions due to conservation. Some legislative proposals require this. But determining the amount of electricity savings and emissions reductions resulting from conservation efforts is difficult and unnecessary if states are required to comply with firm emissions ceilings.

Efforts to achieve emissions reductions through conservation would have to begin years before emissions limits take effect. Progress could be tracked through annual electricity sales and emissions. If a state or region is not moving towards its emissions ceiling as planned, e.g., if consumers don't respond to financial incentives or if economic growth is greater than anticipated, short lead-time measures such as switching to low-sulfur coal could be implemented. Since there is always uncertainty about load growth and the amount of electricity use in the future, states need to make contingency plans for meeting emissions reduction goals regardless of how aggressively they pursue conservation.

We suggest a few other provisions so that federal acid rain legislation encourages conservation and treats efficiency measures as a legitimate means for lowering emissions and compliance costs. First, if some states are given subsidies for acid rain clean-up, investments in conservation measures should qualify as emissions reductions expenditures. Second, acid rain legislation should direct states to consider end-use efficiency improvements and to strive for least-cost energy services (not necessarily minimum electricity costs) when they develop their acid rain compliance plans. This should increase the promotion of and investment in end-use efficiency on the part of utilities.

Regarding the question of how to implement conservation, a variety of policy and program options are available to stimulate greater adoption of electricity conservation measures. States or the federal government can adopt minimum efficiency requirements for new buildings and for lighting products to complement the national appliance efficiency standards promulgated in 1987. Regulatory officials can require least-cost utility planning and allow efficiency measures to compete on equal terms with new sources of electricity supply. Utilities can offer financial incentives to stimulate the adoption of other conservation measures, or even directly install conservation measures in situations where incentives are not effective.

Experience with these policies and programs in regions such as California and the Pacific Northwest has shown that they can substantially reduce electricity demand growth. For example, per capita electricity use fell nearly 1%/yr in California during 1980-85 while it rose 1%/yr in the U.S. as a whole. In recent years, state officials and utilities in Wisconsin have begun to aggressively promote more efficient use of electricity in part to reduce the cost of complying with state acid rain control legislation. Other "acid rain belt" states such as Indiana and Ohio are not recognized as leading states in electricity conservation, but there is no reason why they cannot become so.

## Conclusion

Electricity conservation can play a major role in a national acid rain clean-up strategy. If states and utilities that are very dependent on high-sulfur coal are forced to reduce their SO2 emissions by 50% or more, the economic benefits provided by aggressive efficiency improvements can more than offset the cost of emissions controls. This is true even if flue gas scrubbers are widely implemented.

Whether or not states and utilities have a strong incentive to conserve depends on the approach taken in acid rain legislation. From the perspective of providing full credit for all emissions reductions and encouraging conservation, statewide emissions ceilings are preferable. Emissions ceilings do not stifle economic growth; in fact they give states and utilities maximum flexibility for protecting the environment and providing energy services at least cost.

Thank you for the opportunity to present these views.

Mr. Sharp. Thank you very much, Mr. Geller. Mr. Sant.

## STATEMENT OF ROGER W. SANT

Mr. Sant. Thank you Mr. Chairman. I'm Roger Sant, appearing today as the chairman of the Environmental and Energy Study Institute. I'm accompanied by Pat Raymond and Eric Miller who have done a good deal of the work that we have done on this subject. EESI is a non-partisan public policy organization that was founded by the leaders of the Congressional Environmental and Energy Study Conference and other national policy makers and I'm Chairman of the Board of a very distinguished group of people from all walks of life who contribute greatly to our work.

I'd like to report on a study that we completed in January, 1988, entitled "Strategies For Reducing The Cost of Acid Rain Controls, Electricity Demand Side Management and Clean Coal Technologies." The report was based on 75 interviews with government officials, utility executives, engineers and environmentalists, plus a synthesis of the literature on clean coal technologies and demand side utility load management.

The intent of this project was not to support or oppose pending acid rain control bills, but to explore the role that alternative control technologies like energy conservation could play in mitigating the economic and social impacts of a Federal acid rain control program. This study examined experiences in several States and regions to determine if energy conservation held a significant potential for directly reducing sulfur dioxide and nitrogen oxide emissions as well as reducing the overall costs of an acid rain control strategy.

Through this process, the Institute found that conservation could produce both the emissions reductions and cost reductions significant enough to deserve much greater attention in the current Congressional debate. Our findings were four. First, reduced electricity demand will directly reduce emissions from coal fired generators. Every percent reduction in electricity demand can also produce a percent emission reduction.

Energy conservation can also prevent future increases in emissions by postponing or eliminating the need for construction or operation of new power plants and saves the rate payer those costs. Second, energy conservation will allow more environmental dispatch. Reduced demand will give utilities much greater flexibility with generating capacity, allowing them to preferentially operate their cleaner plants without incurring large additional operating costs.

Third, the marginal costs of achieving the last few tons of reductions required by some of the current legislative proposals, are extremely high. By minimizing the need for more expensive conventional technologies to achieve these reductions, conservation can decrease those high marginal costs.

Fourth and finally and perhaps most importantly, energy conservation is a powerful tool in many respects, not just in $SO_2$ reduction or $NO_x$ reduction. The issue of global climate change is one that particularly comes to mind. Reducing electricity demand and decreasing the burning of fossil fuels can reduce not just $SO_x$ and

$NO_x$, the primary acid rain precursors, but also the greenhouse gas which has caused global warming and in addition, complete competitiveness.

In fact, energy conservation may be the only way to reduce carbon dioxide emissions without significantly altering the American lifestyle. The cost effectiveness of conservation is even higher if conservation gets credit for removal costs of carbon dioxide and other pollutants as well as $SO_x$ and $NO_x$.

Our recommendations are just three and they complement Mr. Geller's testimony in great concert. The first is, if Congress enacts an acid rain control law, energy conservation should be an integral part of total controls strategy. Second, Congress should also adopt statewide emissions ceilings rather than emissions rate standards, to allow utilities to receive full credit for emission cuts achieved by conservation.

Third, any Federal subsidies that are enacted in an acid rain bill, should include energy conservation as an eligible control strategy. As an aside, we'd also recommend that the legislation encourage coordinate planning among the State regulatory, environmental and energy offices which often doesn't occur, to achieve a consensus approach in the State plan. Additional recommendations are included in the attached executive summary of our report.

In summary, let me just say that there are already significant economic incentives for utilities to invest in conservation, particularly those utilities that need to avoid building new capacity. The potential imposition of new pollution controls creates more compelling economic incentives for utilities to look at conservation as a viable business strategy.

Conservation can help achieve pollution control at lower costs than conventional strategies, reduce the need for new capacity, lower consumer energy bills and address the serious problems of global climate change and U.S. competitiveness. I believe that Congress must take advantage of the opportunity brought by the acid rain debate, to send a clear message that conservation can and should play a major role in our national energy and environmental programs. We all believe that today's hearing can take us a number of steps down that road and I appreciate the chance to be here.

[The prepared statement and attachment of Mr. Sant follows:]

# STATEMENT

# OF

# ROGER W. SANT

Mr. Chairman, I am Roger W. Sant, chairman of the board of the Environmental and Energy Study Institute. I am also chairman of the board and chief operating officer of Applied Energy Services, Inc., an independent power producer. I formerly served as assistant administrator for conservation for the Federal Energy Administration and as the director of the Mellon Institute Energy Productivity Center. In 1978, I co-authored "The Least-Cost Energy Strategy" and more recently, in 1984, I co-authored "Creating Abundance - America's Least-Cost Energy Strategy."

I appreciate the opportunity to testify before the House Subcommittee on Energy and Power about energy conservation and the Institute's report, "Strategies for Reducing the Cost of Acid Rain Controls: Electricity Demand-side Management and Clean Coal Technologies." I would like to submit my written statement, which includes the executive summary of that report, for the record and summarize key points orally.

Before I begin my discussion about energy conservation as an acid rain control option, I'd like to briefly describe the Environmental and Energy Study Institute. EESI is a non-partisan public policy organization founded by the leaders of the Congressional Environmental and Energy Study Conference and other national policymakers. Our goal is to meet the need for better informed debate and independent analysis and policy initiatives. The Institute is governed by a diverse, bi-partisan group of environmental and energy leaders.

## The EESI Acid Rain Project

In January 1988, the Environmental and Energy Study Institute completed the initial stage of its acid rain project and published "Strategies for Reducing the Cost of Acid Rain Controls: Electricity Demand-Side Management and Clean Coal Technologies." The report was based on 75 interviews with government officials, utility executives, engineers and environmentalists, plus a synthesis of the literature on clean coal technologies and demand-side utility load management.

The intent of the project was not to support or oppose pending acid rain control bills, but to explore the role that alternative control strategies like energy conservation could play in mitigating the economic and social impacts of a federal acid rain control program. The study examined experiences in several states and regions to determine if energy conservationheld a significant potential for directly reducing sulfur dioxide and nitrogen oxide emissions as well as reducing the overall costs of an acid rain control strategy.

Through this process the Institute found that conservation could produce both emissions reductions and cost reductions significant enough to deserve much greater attention in the current Congressional debate.

## EESI's Significant Findings

The Institute found four major benefits of energy conservation as an acid rain control strategy:

1) Reduced electricity demand will directly reduce emissions from coal-fired generators. Every percent reduction in electricity demand can produce a percent emission reduction. Energy conservation also can prevent future increases in emissions by postponing or eliminating the need for construction and operation of new power plants, and save the ratepayer those costs.

2) Energy conservation will allow more environmental dispatching. Reduced demand will give utilities much greater flexibility in generating capacity, allowing them to preferentially operate their cleaner plants without incurring large additional operating costs.

3) The marginal costs of achieving the last few tons of reductions required by some of the current legislative proposals are extremely high. By minimizing the need for more expensive conventional technologies to achieve these reductions, conservation can decrease those high marginal costs.

4) Finally, and very importantly, energy conservation can be a powerful tool in addressing the issue of global climate change. Reduced electricity demand (by decreasing the burning of fossil fuels) can reduce not just SOx and NOx, the primary acid rain precursors, but also the greenhouse gases which cause global warming. In fact, energy conservation may be the only way to reduce carbon dioxide emissions without significantly altering the American lifestyle. The cost effectiveness of conservation is even higher if conservation gets credit for the removal costs of carbon dioxide and other pollutants, as well as SOx and NOx.

## EESI Continuing Activities:

In our followup to these findings, we have convened a working group of Washington policymakers and experts who are interested in promoting energy conservation as an acid rain control option. That group includes representatives of the ACEEE, National Clean Air Coalition, the Center for Clean Air Policy and the Energy Conservation Coalition.

The workgroup has been monitoring the acid rain debate in the House and Senate, analyzing and discussing legislative developments to determine a consensus on recommendations to promote energy conservation and providing information and assistance to congressional offices on this issue. We plan on continuing those efforts in the future.

## Recommendations

As a result of the EESI study, supported by the work of ACEEE and new information based on a soon-to-be published report on energy conservation in Ohio, the Institute has three major recommendations:

1) If Congress enacts an acid rain control law, energy conservation should be an integral part of a total control strategy. 2) Congress should also adopt statewide emissions ceilings, rather than emission rate standards, to allow utilities to receive full credit for emissions cuts achieved by conservation. 3) Any federal subsidies in an acid rain bill should include energy conservation as an eligible control strategy.

We also would recommend that the legislation encourage coordinated planning among the state regulatory, environmental and energy offices to achieve a consensus approach in the state plan. Additional recommendations are included in the attached executive summary of our report.

## Summary

There are already economic incentives for utilities to invest in conservation, particularly those utilities that need to avoid building new capacity. But the potential imposition of new pollution controls creates more compelling economic incentives for utilities to look at conservation as a viable business tool.

Conservation can help achieve pollution control at lower costs than conventional strategies, reduce the need for new capacity, lower consumer energy bills and address the serious problems of global climate change. Congress must take advantage of the opportunity brought on by the acid rain debate to send a clear message that conservation can and should play a major role in our national energy and environmental programs.

We believe that today's hearing is a very positive step in that direction, and we hope that the Subcommittee will continue their efforts as they consider acid rain control in the future.

Thank you.

ENVIRONMENTAL AND ENERGY
STUDY INSTITUTE

SPECIAL REPORT

# STRATEGIES FOR REDUCING THE COST OF ACID RAIN CONTROLS:

## ELECTRICITY DEMAND-SIDE MANAGEMENT
## AND
## CLEAN COAL TECHNOLOGIES

By Philip Jessup
January 1988

KEN MURPHY, EXECUTIVE DIRECTOR

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# EXECUTIVE SUMMARY

Worrisome even to some staunch supporters of acid rain controls are the potentially adverse effects that using conventional controls—"scrubbers" that remove sulfur oxides from flue gases and switching to low-sulfur fuels—could have on electricity rates and jobs, especially in the Midwest, where medium- and high-sulfur coal mines and energy-intensive industries are important.

In response to these concerns, the Environmental and Energy Study Institute launched a project in the fall of 1986 to explore alternatives to conventional controls that could present opportunities for reducing the overall cost of acid rain legislation. These include electricity demand-side management strategies—load management, conservation and cogeneration—and clean coal technologies that allow medium- and high-sulfur coal to burn more cleanly without the use of conventional scrubbers.

The Institute wishes to state at the outset that it is not the purpose of this report to endorse or oppose acid rain control legislation. However, this report is intended to widen the current debate concerning the range of control options available.

**Methodology**

Information for this report was obtained from a survey of the current technical literature, as well as from more than 75 interviews with engineers, utility executives, environmentalists, emissions control manufacturers and federal and state officials. Two problems encountered were the fragmented nature of information available on demand-side management strategies and clean coal technologies and the lack of comparative data on capital and operating costs.

While this report attempts to present a coherent technical, economic and environmental picture of these strategies, it belies the relative dearth of analytical data available. The conclusions reached, therefore, necessarily reflect the subjective impressions gained from this survey.

The report is divided into three parts. Chapter one provides a more detailed summary of the study's findings, conclusions and recommendations than is offered by this brief executive summary. Readers who wish technical information and analysis concerning the roles electricity demand-side management and clean coal technologies could play in acid rain controls are then referred to chapters two and three. The References section lists the sources of information for this report.

**Findings**

There are two key findings.

First, demand-reducing strategies and new clean coal technologies could reduce power plant and industrial emissions, lower the overall cost of acid rain controls and mitigate the adverse effects of controls on electricity ratepayers and medium- and high-sulfur coal miners. They deserve greater attention than they are currently receiving. Their benefits would be particularly felt in the Midwest, the region that would bear the brunt of emissions reductions were a national acid rain law enacted.

Second, regulatory, financial and institutional barriers will prevent utilities and industries from seriously considering these alternative strategies should certain national acid rain bills be enacted. Some of these barriers are associated with the way many of the bills currently being considered in Congress are structured. Other barriers stem more from state regulatory policies, characteristics of utility systems in the Midwest and commercial market forces.

In order for utilities to seriously consider alternative control strategies within a national emissions control law, lawmakers will have to successfully maximize incentives to make such strategies attractive. Indeed, the regulatory framework itself—whether utilities are allowed to employ clean coal technologies varying in effectiveness on different emissions sources, for example—will be key to encouraging or discouraging alternative control strategies.

**Recommendations**

Serious consideration, therefore, should be given the following recommendations, should Congress decide to enact an acid rain law. These fall into three categories: regulatory incentives, financial incentives and research and information. Regulatory incentives include provisions to maximize the attractiveness of alternative control options by lowering barriers to their wider use. Financial incentives include carrots to speed up the commercialization of these options. Recommendations are also made to improve the analytical information available about these options, for instance, their costs and market potential. Some of these recommendations, especially those stretching timetables, will involve environmental tradeoffs that delay emissions reductions.

*Regulatory Incentives*

Encouragement of demand-side management and clean coal technology control options will require provisions that lower the regulatory barriers to their wider use. Suggestions include:

- ***Flexible source reduction targets.*** Utilities should have flexibility to tailor controls with different $SO_2$ and $NO_x$ removal efficiencies to different sources, as long as an overall statewide reduction target is achieved and environmentally sensitive areas are not adversely affected.
- ***Tonnage reduction compliance standard.*** Under the emissions rate limit approach used in most control bills, utilities would seldom receive full credit for gross emissions reductions achieved by demand-reducing strategies. They should be allowed, therefore, to receive full credit for tonnage reductions achieved using these strategies. This would be accomplished by allowing states to adopt emissions ceilings or tonnage caps as the regulatory approach.
- ***Phased deadlines and extensions.*** The law should contain a two-phase reduction period for $SO_2$ and $NO_x$, with the first deadline around 1994 and the second deadline around 1997. In addition, the second deadline should be allowed to be extended to the year 2000 for certain individual boilers that a utility or industry retrofits or repowers with clean coal technologies.
- ***$NO_x$/$SO_2$ timetable trades.*** Early achievement of $NO_x$ reductions—conventional $NO_x$ controls are available now—should allow a utility to shift the second $SO_2$ reduction deadline toward the year 2000.
- ***Conservation trades.*** Since conservation programs can be mounted quickly, utilities should be encouraged to undertake them early on to reduce $SO_2$ and $NO_x$ emissions. Early reductions should be rewarded with deadline extensions for $SO_2$.
- ***Scrubber trades.*** Utilities should be encouraged to undertake early scrubber retrofits on their largest plants. Early $SO_2$ emissions reductions achieved by scrubber retrofits on large plants would be rewarded with deadline extensions on smaller, more expensive-to-control plants.
- ***Regulatory preferences.*** Relatively simple modifications in federal legislation governing non-utility power producers should be made to allow fuel cells and other promising clean coal technologies to receive preferential treatment now accorded conventional cogeneration and renewable energy sources.
- ***Interstate air quality management authorities.*** A special title should allow neighboring states to form and operate air quality management authorities for the purpose of implementing interstate strategies for emissions reductions, including emissions trading among states.

*Financial Incentives*

Incentives should be incorporated into a national acid rain law to encourage utilities to seriously consider and pursue demand-side management and clean coal options. These incentives could include:

- ***Demand-side financial incentives.*** Federal law should encourage state public utility commissions to treat load management and conservation expenditures like scrubbers, i.e. capital investments. One way to do this would be to qualify demand-reducing equipment and programs for subsidy, should the bill provide subsidies to utilities to reduce emissions.
- ***Federal demonstration block grant program.*** The quickest, most effective way to

promote commercialization of clean coal technologies for existing boilers would be to allow states and utilities to choose freely the most promising, cost-effective technologies and subsidize them. This would be accomplished by block grants from the federal clean coal technology program to those states that wish to promote the technologies. The national interest would be best served, on the other hand, by using the balance of the clean coal program to demonstrate advanced power generation systems for new plants.

***Research and Information***

There is a vital need for the federal government to more actively assess the role that alternative emissions control strategies like demand-side management and clean coal technologies could play. Suggestions include:

- ***National computer models.*** Both the U.S. Environmental Protection Agency and the U.S. Department of Energy should reassess the computer models they use to simulate the behavior of the domestic electricity markets. These models should be modified to examine policy options other than just scrubbing and coal-switching.
- ***Demand-side management control strategy study.*** A national analytical study of demand-side strategies and the role they could play in reducing emissions and mitigating conventional control costs should be undertaken as soon as possible.
- ***National clean coal engineering and cost study.*** A national site-specific study of the market for retrofit and repowering technologies should be conducted. This would furnish comparative technical and economic data that is vitally needed to properly assess the potential role these technologies could eventually play in acid rain controls and the savings they could bring if used.

In conclusion, Congress can craft, if it wishes, an acid rain law that broadens the control options available to utilities and mitigates adverse economic effects on both electricity ratepayers and coal miners. Demand-side management strategies like conservation would help the electricity ratepayer, and clean coal technology incentives would protect coal jobs. Both strategies would reduce emissions.

Conventional controls like scrubbers and switching to low-sulfur would still have to be used, of course. Encouraging alternative control strategies that lower compliance costs and protect ratepayers and coal jobs will, however, help ease some of the pain associated with the more conventional controls.

Mr. SHARP. Thank you very much, Mr. Sant. Mr. Trisko, perhaps you're next.

## STATEMENT OF EUGENE E. TRISKO

Mr. TRISKO. Thank you, Mr. Chairman. We appreciate the opportunity to appear before you today. From our perspective, the integration of energy conservation programs and acid rain control policy is unnecessary as a mechanism to encourage energy conservation in the economy and in short, is a recipe for an unworkable acid rain control policy. The acid rain control debate, Mr. Chairman, as you well know, has been going on for some 7 years now.

It does not suffer from a lack of complexity and we see the introduction of the energy conservation issue as an unnecessary complexity for the resolution of the acid rain control issue. The debate here this morning really is a very technical one. It's the debate which concerns the mechanism that Congress might use to apportion emission reductions under acid rain control legislation among the States.

There are basically two competing alternatives. One is a tonnage approach. The tonnage approach is favored by advocates of energy conservation on the ground that a tonnage program will give States full credit for conservation related emission reductions. The other approach is an emission rate control policy, either enforced as a statewide average as in Mr. Waxman's acid rain control proposal or on a plant-by-plant or systemwide basis.

Proposals of that nature typically are related to the useful lifetimes of power plants, for example, the 30-year, 1.2 pound $SO_2$ control policy. We believe that Congress should not adopt a tonnage based approach to acid rain control for the sake of encouraging energy conservation because the tonnage based approach is first, extraordinarily difficult for States to administer; second, potentially inflexible in the face of uncertainties about future economic growth and fuel use patterns; third, inconsistent with ongoing Federal Energy Regulatory Commission proposals which are leading to the deregulation of the electric power industry and; finally, unnecessary in view of other Clean Air Act programs.

Instead, the regulation of emission rates on a plant-by-plant or systemwide average basis, appears, in light of the above considerations, to be the preferable alternative for Congress to pursue. The major point developed in our submission, Mr. Chairman, is that energy conservation programs are working very successfully around the United States. The Electric Power Research Institute has surveyed the utility industry and has found that there are several hundred programs now in operation within the utility industry to encourage energy conservation.

The reason for this, Mr. Chairman, is quite straightforward. The cost of new generating capacity has increased fourfold in the last 10 years. It now costs in excess of $1,100 to add an incremental kilowatt of generating capacity. It's largely as a result of these cost increases in generating capacity that utilities, as a matter of self interest, have pursued energy conservation programs.

Similarly, the National Association of Regulatory Utility Commissioners has surveyed the States and found that some 33 States, or about two thirds of the States in the Nation are currently utilizing or developing least-cost utility planning programs and those programs will force utilities to consider conservation as a cost effective alternative to the construction of new plants.

One of the principal issues regarding the tonnage approach to acid rain control is the full credit argument that States will not receive full credit for conservation related emission reductions under an emission rate approach—only a tonnage based approach allegedly will give States full credit for those programs. Mr. Chairman, we believe that that is a misleading assertion because it ignores the increasing separation, geographic separation of sources of electric power, supply and demand.

Just as an example, Mr. Chairman, I gave to your staff this morning, some additional data which we'd like to have entered into the record which show the trend of net generation and sales to other utilities by the Allegheny Power System. This is a utility holding company which serves portions of five States—West Virginia, Pennsylvania, Ohio, Maryland and Virginia. Now, the database that we've assembled here, covers the period from 1970–1978 and it reflects the impact on Allegheny Power's power wholesaling activities following the initial oil price spike in 1973.

The data indicate that in this period of time, Allegheny Power System was selling on the order of one third of its kilowatt hour generation to other utilities, mainly in the mid atlantic region—Pennsylvania, New Jersey, Maryland interconnection. It was doing that in order to displace oil fired generation in those regions. The net of that, Mr. Chairman, is that a successful energy conservation program in a given State such as New Jersey, may not necessarily reduce emissions in the State of New Jersey.

Instead, emissions could be reduced in Pennsylvania or Ohio or Indiana for that matter. So there's no direct cause and effect relationship between energy conservation and electric power emission reductions. Mr. Chairman, the Federal Energy Regulatory Commission has a variety of proposals which will tend to further increase the amount of wholesale power transactions which occur in the power industry.

The effect of those will be to increase shopping for electric power, both by major utilities looking at cheaper power sources in other States and by major customers, such that for example, General Motors will no longer have to do business with Detroit Edison as its principal power supplier. Instead, General Motors could shop in Texas or in Tennessee or in Georgia for that power which would be, in turn, wheeled from the southern part of the country up to Michigan.

I'd like to respond specifically to one of the assertions that is made with regard to statewide average emission rates and that assertion is that a statewide average rate will encourage utilities to build new capacity in order to reduce their average emission rates under that kind of proposal. The cost of new generating capacity today, compared to the cost of the extending the lifetime of an existing plant, even with additional emission controls under that life extension program, is such that utilities have no economic incentive to build new capacity.

Instead, they will simply refurbish and extend the lifetimes of their existing units. Second, will utilities resist energy conservation programs in order to keep their most expensive, peak load generation units on line, and thereby reduce their average $SO_2$ emission rates under an emission rate program? We think the answer to that is a pure and simple no, Mr. Chairman.

Utilities confronted with acid rain legislation will either scrub or switch their existing base load capacity units which are not subject to new source performance standards. The peak load units which are the most sensitive to successful conservation programs, tend to have one, very low emission rates; and two, very high operating costs. They do not contribute much to a utility's overall $SO_2$ emissions.

Finally, I know that I've run over my time, Mr. Chairman, so I'd just like to end on the following point: that the energy conservation issue will have to be confronted four-square by Congress when it comes to grips with the global warming or greenhouse gases controversy. Energy conservation appears to be, at best, a collateral issue to acid rain control.

It's in the context of global warming that Congress will have to address national energy conservation programs in the context of environmental policy. That may be the place to integrate energy conservation and environmental protection. Acid rain does not appear to be the appropriate venue for that. Thank you very much.

[Testimony resumes on p. 147.]

[The prepared statement and attachments of Mr. Trisko follows:]

Statement of Eugene M. Trisko*
Executive Vice President
Stern Bros., Inc.

Before the Subcommittee on Energy and Power
Committee on Energy and Commerce
United States House of Representatives

Washington, D.C.
June 15, 1988

Mr. Chairman and members of the Subcommittee, Stern Bros., Inc. ("SBI") appreciates the opportunity to appear before you today. SBI is an energy holding company with high-sulfur coal reserve and other energy interests in West Virginia. Since 1980, we have been closely involved in the Clean Air Act reform debate, focusing on alternative legislative approaches to acid rain control. We have worked informally with representatives of industry, labor, and environmental groups, with EPA and Congressional staff members, and with other groups committed to "middle-ground" solutions to the complex environmental and economic problems inherent in the acid rain control debate.

Our testimony today addresses the following question:

> "If Congress determines that new legislative measures are needed to control acid precipitation, should energy conservation be given explicit consideration in the design of those measures?"

We conclude that energy conservation and acid rain control policies should not be interrelated explicitly. While energy conservation itself is a desirable objective, the means considered necessary to integrate it within an acid rain control program have serious disadvantages. The state-based sulfur dioxide tonnage reduction approach to acid rain control favored by energy conservation groups appears to be:

1) Inflexible and imprudent in the face of uncertain future patterns of economic growth and fuel use;
2) Unduly difficult to enforce, particularly in view of the increasingly attenuated geographic relationship between electric power supply and demand, such that power consumed in one state often is produced in another state; and
3) Inappropriate in light of existing Clean Air Act programs.

The rapid changes now overtaking electric utility supply and demand planning, triggered by new federal regulatory initiatives under PURPA and by state least-cost planning efforts, imply that states are no longer the appropriate unit of measurement for compliance with acid rain legislation.

Today, the regulation of emission rates on a plant-by-plant or utility system basis is the only practical and enforceable way to secure long-term emission reductions below current levels. From an environmental standpoint, both the tonnage approach and the emission rate approach appear acceptable as means to reduce future emissions of sulfur dioxide.(1) Either approach would encourage energy conservation through its impact on electric rates, particularly in the Midwest.

## The Energy Conservation Movement

Despite the ups and downs of oil prices in the past decade, energy conservation works. Since 1974, the ratio of energy consumption to real GNP has dropped steadily by more than one-fifth.(1) Energy conservation is now institutionalized, in the form of dozens of grass-roots citizens' groups, and consumer advocates operating within state public utility commissions.

Energy conservation works because conservation is cheaper than new powerplants, and cheaper than the delivered cost of electricity from existing powerplants. Utilities throughout the country are actively pursuing demand-side management programs to reduce electric consumption through measures such as better insulation, free energy audits, and experimental load control devices.

As in other regulatory areas which have not been fully preempted by federal law, states have taken different approaches to the promotion of energy conservation. TVA and states in the Northeast and West have taken a more active interest than some states in the Midwest and South. The program developed just a few weeks ago in Connecticut will serve as a model for energy efficiency programs in other states.(3)

Many utilities encourage energy conservation as a matter of self-interest. Concerns about the cost of capital for new plants, the demise of the nuclear option, and uncertainties about "prudency reviews" for new plants by state utility commissions have led utilities to develop programs to reduce peak load growth, and to extend the lifetimes of their existing generating plants. One fact underscores this self-interest: the weighted average cost of large new fossil-fueled powerplants increased four-fold in the past decade, from $228 per kilowatt of capacity in 1975 to $1,079 per kilowatt in 1984.(4)

In response to these new economic facts of life, state public utility commissions are pioneering the development of "least-cost utility planning" processes which will force utilities to consider conservation as an alternative to new generating plants. The National Association of Regulatory Utility Commissioners indicates that 17 states have least cost energy planning programs underway, 4 states incorporate least cost planning in other programs, and 12 states are developing or considering such programs.(5) With 33 states now at work on least-cost planning, the implications for reduced powerplant construction are profound, especially over the next 20 years.

In sum, energy conservation is firmly taking root in the utility sector and in state regulatory processes. Energy conservation does not need acid rain legislation to make it work better. However, by raising the cost of electricity in many regions of the country, and particularly in the Midwest, any form of acid rain control legislation would promote energy conservation through the price elasticity effects of higher electricity prices. As such, acid rain legislation and energy conservation programs are independent but complementary policy objectives.

### Energy Conservation and Emissions Control Policy

Energy conservation alone will not produce long-term emission reductions nearly as large as those called for by current acid rain control proposals.(6) Looking at these proposals, energy conservationists maintain that emission-rate approaches would not provide states full credit for emissions reductions achieved as a result of conservation programs, and might encourage utilities to build new plants in order to reduce their average emission rates under statewide-average emission rate bills.(7)

Emission rate proposals are based on the amount of SO2 emitted per unit of one million BTU heat input. For example, a coal with 12,000 BTUs per pound and 3 percent sulfur by weight would have 60 pounds of sulfur per ton, or roughly 120 pounds of SO2 when burned. Each ton of coal would contain 24 million BTUs. When the 120 pounds of SO2 are emitted as the ton of coal is burned, it would be at a rate of 5.0 pounds of SO2 per MMBTU (120/24=5.0).

Emission rate control proposals typically take two forms:

1) Statewide average SO2 emission rates (e.g., 2.0 and 1.2 pounds of SO2 per million BTU heat input, to be achieved in two phases as in the Waxman bill); or

2) Plant-specific SO2 emission rates (which may or may not be "bubbled" or traded on a systemwide, statewide or interstate basis), triggered when a plant reaches a specific age (e.g., 30-year/1.2 pounds of SO2).

Energy conservation groups favor statewide SO2 tonnage reduction programs: here, each state is assigned a tonnage reduction to achieve by a future date, usually based on the state's share of "excess emissions" above 1.2 pounds of SO2 in a baseline year such as 1980. States would have complete flexibility in the choice of control measures to achieve these tonnage reductions, including energy conservation. Tonnage reduction proposals also may place a ceiling on the total emissions of SO2 in each state after the initial reduction is achieved. Such ceilings could affect only emissions from existing plants, or emissions from both new and existing sources.

In order to determine how emission-rate and tonnage reduction proposals would affect energy conservation programs (and vice versa), it is necessary to understand utility plant utilization patterns and how these may change over time in response both to potential acid rain legislation and to conservation programs. A snapshot of one utility's plant dispatch sequence on one day does not provide an adequate basis for policy determinations about these matters.(8)

Table 1 compares the operating characteristics in 1985 of five large plants in West Virginia and Pennsylvania. One of the plants in each company is a New Source Performance Standards (NSPS) station equipped with a scrubber system: Monongahela Power's Pleasants station, and Pennsylvania Power's Mansfield station. Neither of these NSPS plants would be required to reduce emissions under an emission rate or tonnage approach to acid rain control.

The other plants in Table 1, generally older and not subject to EPA's NSPS, would have to achieve substantial reductions under current acid rain control proposals. Given the small production cost differences between the NSPS and pre-NSPS units (about three-tenths of a cent per kwh), additional operating costs at pre-NSPS plants due to new emission control requirements could lead to decreased utilization of the older plants in Table 1 in favor of even greater utilization of the NSPS units.

Table 1. Operating Characteristics of Five West Virginia and Pennsylvania Power Plants, 1985

| Utility/Plant | Capacity (MW) | Generation (Mil. Kwh) | Plant Factor* (%) | Prod. Cost (mills/kwh) | Fuel Sulfur (%) |
|---|---|---|---|---|---|
| Monongahela Power Co. | | | | | |
| Pleasants (NSPS) | 1,242 | 7,190 | 60 | 20.11 | 2.7 |
| Harrison | 1,861 | 10,958 | 61 | 17.21 | 2.9 |
| Ft. Martin | 1,107 | 6,633 | 66 | 17.16 | 1.8 |
| Pennsylvania Power Co. | | | | | |
| Mansfield (NSPS) | 2,360 | 14,031 | 64 | 25.24 | 3.8 |
| New Castle | 416 | 1,773 | 48 | 21.78 | 1.4 |

*Ratio of average plant load to total plant production capacity.

Source: DOE, "Historical Plant Cost and Annual Production Expenses for Selected Electric Plants, 1985," (DOE/EIA-0455(85), June 15, 1987. Fuel sulfur data are calculated from FERC Form 423 for 1987.

On the other hand, successful energy conservation programs may have very little impact on the utilization of any of the large baseload plants in Table 1. The plants most sensitive to successful conservation efforts are intermediate and peak load units, which tend to have low emissions (especially pumped-storage hydro and gas turbines) and higher operating costs than baseload plants. In this sense, conservation programs could discourage operation of some of the cleanest plants in a utility system. However, the contribution of peak and intermediate load units to total utility SO2 emissions is generally quite small because they are operated less frequently than baseload plants. It is unlikely that a utility faced with major emission reductions under statewide average emission-rate legislation would resist conservation efforts in order to keep its expensive peak load units in operation for the benefit of a negligible reduction in its average SO2 emission rate.

The issue of comparative utilization of NSPS and pre-NSPS plants deserves greater scrutiny than has occurred to date among studies of the relationship of energy conservation and acid rain control. Before reaching a judgment about the need for explicit integration of these two policy areas, the Subcommittee should pursue a detailed examination of this point, covering several utilities in different regions of the country.

Finally, given the extremely high costs of new plant capacity, the claim that utilities may be encouraged to build new plants in order to reduce their average emission rates under acid rain legislation cannot be taken seriously. It is much cheaper to extend the lifetime of an existing unit, even with new emission controls, than to construct new capacity.(9)

## Electric Power Deregulation:
## Uncoupling Geographic Supply and Demand

The proposition that states could achieve full credit for conservation-related emission reductions under a statewide tonnage approach is a central argument in these hearings. We believe that this proposition is misleading because it overlooks the present structure and changing dynamics of the electric power industry.

The Public Utility Regulatory Policies Act of 1978 (PURPA) has revolutionized the way utilities plan for new capacity additions, and new proposed FERC regulations may pave the way for near-total deregulation in the supply and interstate transmission of power. Two trends are clear: 1) increasing competition in the supply of new power sources, driven by the "Qualifying Facility" and "Independent Power Producer" provisions of PURPA and related FERC regulations and proposals; and 2) greater geographic flexibility for major power users in the choice of power supplies, also a product of FERC initiatives.(10)

As a result of these trends, supply and demand will become increasingly geographically decoupled. Major industrial users like General Motors in Detroit may negotiate for electric power supplies from Georgia, Texas or Ohio. Utilities themselves will shop for the cheapest sources of power in other states. States no longer will have the control they once exercised over the "natural monopoly" of electric power. The electric utility industry, already heavily interconnected for reliability, is on the verge of becoming a national marketplace.

For these reasons, successful state energy conservation programs will be geographically decoupled from emission sources: conservation-related demand reductions in New Jersey or Connecticut may reduce powerplant emissions in Pennsylvania, Indiana, Ohio, or even Canada. This is true today with existing power interchanges, will become even more so under current FERC programs and initiatives, and would be the case under either emission rate or tonnage-based acid rain controls.

Indeed, what the tonnage-based approaches do not recognize, or adequately provide for, is the need for flexibility to accommodate the changing shape of power supply-demand relationships. States are not discrete islands of power supply and demand. Power already flows through the interconnected electric reliability councils like water mixing in a bathtub. Emission rate control proposals are much more adaptable to these conditions: utilities pick the coal supply by sulfur content, or the emission control technology, and run with it. States can enforce these emission rates just as they have become accustomed to under other Clean Air Act emission-rate programs.

## The Need to Preserve Future Flexibility

The Clean Air Act contains numerous examples of Congress's efforts to balance environmental protection and economic growth: the distinction between stringent emission control requirements for new plants and ambient air quality standard compliance for existing stationary sources; the Prevention of Significant Deterioration policy for clean-air regions, with optional growth provisions for areas desiring more industrial expansion; and the emission offset program for accommodating new industrial growth even in nonattainment areas.

The tonnage-based approach to acid rain control leads in another direction. By potentially imposing ceilings on allowable total SO2 emissions on a state-by-state basis, for new or existing plant emissions or both combined, the tonnage approach conceals rigidities which could limit future utility fuel supply choices, and constrain competition in power supply and demand. Emission rate approaches, on the other hand, could achieve comparable or larger long-term emission reductions while preserving future economic growth options through compliance with existing Clean Air Act PSD and NSPS programs.(11)

In 1987, 54.8 percent of U.S. electric generation was supplied by coal, 19.2 percent by nuclear, 14.4 percent by oil and gas, and 11.6 by hydro and other sources. (12) In the Northeast, oil and gas supplied one-third of all power generation, and in Texas it supplied about one-half.(13) The reliability region composed of Oklahoma, Arkansas, Louisiana, Missouri and Kansas used oil and gas for about one-quarter of its 1987 electric power production. This pattern of oil and gas use is not expected to change much over the next ten years.(14)

However, the days of $18 per barrel oil and $2.50 MCF gas are numbered. There seems to be agreement that current energy prices are unstable and will move upward during the period now contemplated for compliance with acid rain control legislation - the mid-1990s to early 2000s. Utilities dependent on oil and gas will need alternative sources of power when this occurs.

Emission-rate and tonnage-based approaches to acid rain control policy diverge at this point. Emission-rate approaches (both statewide average and plant-by-plant or utility) would allow plants to shift away from gas and oil to NSPS coal plants or other supply sources. Total tonnage proposals with state emission ceilings could constrain available choices in states with low average emission rates (e.g., Oklahoma and Louisiana). With no nuclear option, a fixed supply of hydro, and emissions constraints on coal conversion, conservation and nonconventional power sources would appear the only viable alternatives.

## Implementation and Enforcement Considerations

There are two basic issues here: 1) how should emission reductions for acid rain be measured and apportioned; and 2) how enforceable are the emission control programs? On both counts, there are substantial reasons for favoring plant-by-plant or utility system emission rates over any form of statewide average emission rate or tonnage regulation.

Statewide average emission rate or tonnage-based controls would involve an extraordinarily complex enforcement effort on the part of the states. A statewide reduction program would entail the unprecedented regulation of load factors of individual powerplants or groups of plants. Utilities would have to predict their patterns of plant utilization years in advance to prepare a compliance strategy. Unscheduled plant outages, variances in interchange power purchases and sales, and a host of essentially unpredictable variables would make accurate predictions virtually impossible. A change in one utility's emission rates or tonnages in a state would have to be compensated for by another system, with the state air pollution regulators in the middle. Compliance would become a crapshoot.

Plant-by-plant or utility system emission rates can be gauged through stack gas monitors and controlled by fuel sulfur content or emission control technology. There is virtually no uncertainty about compliance with emission rates on a plant-by-plant basis, and a system-wide average can be readily calculated.

An additional drawback of statewide tonnage-based approaches is their reliance upon a rollback of emissions from a prior baseline year, typically 1980. If emissions from both utility and industrial sources were included in the baseline calculation for each state, there would be sufficient uncertainty about industrial emissions to invite litigation and delay in program implementation.(15)

In theory, it is possible to convert an emission-rate approach like the "30-year/1.2 pound SO2" option or a statewide average to a statewide tonnage-based program. However, the implementation and enforcement difficulties associated with such a hybrid approach would be similar to those of other statewide reduction proposals.

## Policy Integration Concerns

The Clean Air Act is an elaborate scheme of ambient air quality regulation built around ambient air quality standards and emission rates to achieve them. How well would the tonnage-based and emission-rate approaches to acid rain control fit into the fabric of the existing Act? What programs in the Act would be affected by the adoption of either of these acid rain proposals?

On balance, the emission rate approach to acid rain control appears more consistent with the Clean Air Act's general approach to air quality regulation than the tonnage alternative. This is simply because emission rate regulation is at the core of most of the Act's existing programs (both for stationary and mobile sources), while the tonnage approach would convert the Act's regulation of one pollutant (SO2) from ambient air quality management to total emissions "loadings."

To illustrate these issues, assume Congress enacted a total tonnage reduction program for SO2 with a fixed ceiling on total SO2 tonnage after an initial rollback. How would this square with continued implementation of the PSD program? The available PSD "increments" would expand by the size of the ambient air quality improvement caused by the initial rollback at plants which had established PSD ambient air quality baselines. In theory, huge increments for future emissions growth would be available at such facilities. But under a total tonnage ceiling, additional emissions might not be permitted at these plants.

For another example under the same facts, consider the tall stack limitations in section 123. This provision was added by Congress in 1977 to restrict total emissions of SO2 by allowing modeling credit only for emissions based on "Good Engineering Practice" (GEP) stack heights. Section 123 does not prohibit tall stacks, only the credit for stack heights above GEP in computer modeling to determine compliance with ambient air quality standards. Under a fixed tonnage ceiling for SO2, section 123 would serve no purpose: the emissions control objective Congress had in mind in 1977 would be fulfilled by the SO2 tonnage rollback and ceiling on future SO2 emissions growth.

The purpose of these examples is merely to suggest that several program areas under the existing Clean Air Act could be substantially revised or even eliminated if Congress were to pursue a tonnage-based restriction on future SO2 emissions.

In contrast, plant- or system-based emission rate controls could work with the Act's existing PSD, NSPS, tall stack, and other emissions-oriented programs. Following the initial emission reduction, new emissions growth would be limited through compliance with NSPS, case-by-case reviews for Best Available Control Technology under the PSD program, by the PSD increment system, and other new source provisions of the Act. The balance which Congress struck in 1970 and 1977 between clean air and economic growth would remain operative.

Finally, it seems appropriate to point to a more fundamental energy conservation issue facing Congress: the global warming or greenhouse gases problem. The issues raised here today may pale in relation to the scope of a national (and international) energy conservation program directed toward global warming.

Greenhouse gases and their resulting impact on global climate change will provide the forum in which national conservation and energy policies will have to be addressed in the most fundamental terms. It may well be that Congress could adopt an emission rate strategy for the control of greenhouse gases, as it has with other pollutants, together with major new energy conservation initiatives. Unlike acid rain control, this could be the right opportunity to combine air pollution and energy conservation objectives in one legislative enactment.

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*B.A., Economics and Politics, New York University (1972); J.D., Georgetown University Law Center (1977); Attorney, Federal Trade Commission, Washington, D.C. (1977-79).

Footnotes

1. Federal Reserve Bank of San Francisco, "Oil and the Economy," May 27, 1988.

2. Testimony of Dr. Robert Friedman, U.S. Office of Technology Assessment, Before the Subcommittee on Energy and Power, Committee on Energy and Commerce, U.S. House of Representatives, May 26, 1988.

3. "Utility Sets Plan to Cut Power Use," The New York Times, May 26, 1988.

4. U.S. Department of Energy, "Historical Plant Cost and Annual Production Expenses for Selected Electric Plants 1985," (DOE/EIA-0455(85)), June 15, 1987, Table 15.

5. National Association of Regulatory Utility Commissioners, "1987 Report of the Committee on Energy Conservation," at 59.

6. See e.g., Howard Geller et al., American Council for an Energy Efficient Economy, "Acid Rain and Electricity Conservation," June 1987, Fig. S-2. Accelerated conservation in the ECAR region would reduce SO2 emissions by less than one million tons annually in 1995-2005, from a base of 5 million annual tons.

7. Id. at 5-5 - 5-7.

8. See id. at Fig. 5-1 (TVA dispatch order for March 25, 1987).

9. Id. at 5-8.

10. See generally, "Utilities Flirt with Adam Smith," Fortune, June 6, 1988 at 173-181; Steven Ferry, "The Electric Wheel of Fortune," The Amicus Journal, Spring 1988 at 10-12; Regulatory Research Associates, Inc., "Regulatory Focus, Final Report: FERC Proposals on Avoided Cost Determination and Independent Power," March 28, 1988.

11. ICF Incorporated, Memorandum to Rob Brenner, U.S. EPA, "Utility SO2 Emission Targets Under Phased 1.2, 2.0/1.2 lb. Rate and Cooper Bill Scenarios," May 4, 1988.

12. North American Electric Reliability Council, "1987 Electricity Supply and Demand for 1987-1996," November 1987, Table 17.

13. Id.

14. Id.

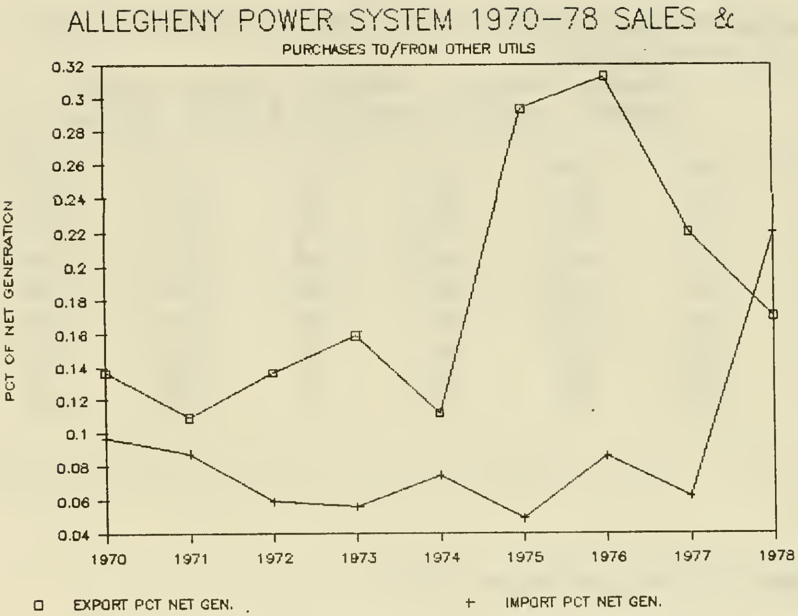
15. For a discussion of implementation and enforcement difficulties under a tonnage-based bill, see National Clean Air Coalition, "Critique of H.R. 4331: Cooper Acid Rain Bill," May 25, 1988.

ALLEGHENY POWER SYSTEM NET GENERATION AND SALES AND PURCHASES TO OTHER UTILITIES, 1970-78
IN MILLIONS OF KILOWATT HOURS

| YEAR | NET SYSTEM GENERATION | EXPORTS TO OTHER UTILS | IMPORTS FROM OTHER UTILS | EXPORTS PCT. OF NET GEN. | IMPORTS PCT. OF NET GEN. |
|---|---|---|---|---|---|
| 1970 | 22298 | 3045 | 2164 | 13.66% | 9.70% |
| 1971 | 23015 | 2512 | 2013 | 10.91% | 8.75% |
| 1972 | 26135 | 3556 | 1546 | 13.61% | 5.92% |
| 1973 | 28922 | 4587 | 1626 | 15.86% | 5.62% |
| 1974 | 27315 | 3049 | 2038 | 11.16% | 7.46% |
| 1975 | 33582 | 9854 | 1646 | 29.34% | 4.90% |
| 1976 | 36596 | 11458 | 3150 | 31.31% | 8.61% |
| 1977 | 35069 | 7696 | 2178 | 21.95% | 6.21% |
| 1978 | 29706 | 5057 | 6518 | 17.02% | 21.94% |

SOURCE: FEDERAL POWER COMMISSION FORM 12, 1970-78

NOTE: ALLEGHENY POWER SYSTEM CONSISTS OF MONONGAHELA POWER COMPANY, WEST PENN POWER COMPANY, AND THE POTOMAC EDISON COMPANY. IT SERVES CUSTOMERS IN PORTIONS OF WEST VIRGINIA, PENNSYLVANIA, MARYLAND, OHIO AND VIRGINIA. IN 1987, IT HAD INSTALLED GENERATING CAPABILITY OF 7,991 MEGAWATTS. OF ITS 47,541 MILLION KWH GENERATION IN 1987, 14,709 MILLION KILOWATT HOURS WERE SOLD TO OTHER UTILITIES. (1987 APS ANNUAL REPORT.)


ALLEGHENY POWER SYSTEM 1970–78 SALES &
PURCHASES TO/FROM OTHER UTILS
PCT OF NET GENERATION
0.32
0.3
0.28
0.26
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
1970
1971
1972
1973
1974
1975
1976
1977
1978
□ EXPORT PCT NET GEN.
+ IMPORT PCT NET GEN.

## STATEMENT OF DAVID MOSKOVITZ

Mr. MOSKOVITZ. Thank you very much, Mr. Chairman. I'll keep my remarks very brief so we have more time for the question period.

I do want to thank you for this opportunity to testify before you. And while the testimony that I've submitted and the attachments are primarily mine, I would like to say that the material has now been reviewed by the Chair of New York's Energy Conservation Committee and he agrees, as I thought originally, that my testimony is completely consistent with all of their views, so you really have the testimony of more than just one State commissioner.

Let me emphasize just two points in my oral remarks. Whenever one embarks on the task of establishing a regulatory framework, it's very important to be aware of the incentives that the creation of a particular framework will create.

That's true both for economic regulation and environmental regulation. Unfortunately, as the paper that I've attached to my testimony points out, the system of economic regulation that we now have in place at both the State and Federal level for electric utilities is tilted very heavily against energy conservation, energy efficiency improvements, regardless of how cost effective they are.

In fact, in some respects the more cost effective they are, the more heavily the system is tilted against them. The task of reforming the economic side of regulation certainly in large part lies at the feet of State regulators and I can assure you that we are working on it and we certainly hope to have something in place, in at least several States, in the very near future.

We certainly hope, however, that the same mistake that was made in economic regulation of electric utilities isn't repeated when Congress takes necessary steps to move the Nation forward on its acid rain policies.

We certainly would think it would be the last thing one would want to do when creating an acid rain strategy, is to adopt a particular regulatory framework that encourages new plant construction or discourages energy conservation.

Let me also say as my only second point is that energy conservation is a cheaper way to control acid rain, producing emissions, and controlling the effects of those emissions either before or after a fossil fuel is burned.

For that reason alone, the availability of energy conservation as a control strategy should receive a very high priority by Congress.

Regulators all around the country are certainly pursuing least cost planning as an energy strategy. As the attached paper, though, explains that pursuit, however, is likely to go nowhere without substantial reform to the economic system that we now use to regulate electric utilities.

Most of what we'll see will tend to be in the nature of lip service to energy conservation. I think we've only scratched the surface of what can actually be accomplished, if the rules of the game only changed.

The same principles, that is of least cost planning, seem to be applicable in the environmental area and designing any acid rain control strategy that allows conservation to compete on a cost basis against other control techniques, be it fuel switching or scrubbing, only means that consumers can win.

That's all I plan to say at this point. I'll be happy obviously to answer your questions during the question and answer period.

[Testimony resumes on p. 174.]

[The prepared statement and attachments of Mr. Moskovitz follows:]

TESTIMONY
David Moskovitz, Commissioner
Maine Public Utilities Commission
Before the
U. S. House of Representatives
Committee on Energy and Commerce Subcommittee
on Energy and Power

Representative Sharp and Committee Members--

I appreciate being given this opportunity to testify before you on the role of energy conservation in the nation's acid rain policy. Like public utility commissioners in most states, my jurisdiction is primarily limited to economic regulation of public utilities. Other state agencies are responsible for environmental regulation. Nevertheless, like all public utility commissioners, I believe it is vitally important to move forward to develop and implement a national response to the acid rain problem. As one that regulates the economic aspects of power production, I may set forth three basic principles of good regulation.

First, economic regulation should produce prices to consumers for utility products that reflect the costs of the product. Second, all costs imposed on society that can be identified that result from the production of the product should be included in the prices charged for the product. This includes both long and short term environmental costs of production of power. Thus, it should come as no surprise that state regulators were supportive of the decision to include the cost of nuclear waste disposal and plant decommissioning costs as a component of the costs today's ratepayers must bear. Third, and perhaps most relevant to today's session is that there are many alternative forms of economic or environmental regulation. The system of regulation selected should be designed to provide the correct incentives. As I will discuss later, this is an area in which substantial improvement needs to be made.

Turning to the four questions I was asked to address. First, "what is the potential for an electricicity conservation component of a strategy for reducing acid deposition?" In preparation for today's session I have reviewed "Acid Rain and Electricity Conservation" Report by the American Council for Energy Efficient Economy (Geller, et al., June 1987) and "Strategies for Reducing the Cost of Acid Rain Controls: Electricity Demand-Side Management and Clean Coal Technologies" by the Environmental and Energy Study Institute (Phillip Jessup, January 1988). I find myself in substantial agreement with the conclusions of both of these reports. The technical potential for additional electricity conservation is enormous. Because greater efficiency means less fossil fuel combustion energy conservation, energy conservation can also contribute substantially to the reduction of emissions of acid rain producing compounds (the same statement would apply to greenhouse gases). The conclusions of the ACEEE Report that energy conservation in the ECAR Region can achieve a 26% reduction in the amount of energy used to fuel the region's economy is typical of the studies I have seen for New England as well as other areas of the country. For example, a recent report by the New England Energy Policy Council titled "Power to Spare" reached similar conclusions for the New England region. As a general matter, a full implementation of currently available technologies can result in electricity reduction in the range of 25-50% on a cost effective basis without lowering the end use level of energy services. There is generally little opposition to estimates of the "technical potential" of conservation and energy efficiency improvements for reducing the demand for electricty. Instead opponents generally focus on differing estimates of market penetrations. While I have more detailed information available, the precise contribution of energy conservation to a control policy does not seem to be a critical piece of information.

The second question was "what is the potential for an electricity conservation component of the strategy for reducing the cost of an acid rain program"? For the most part there is no cost of using electricty conservation as a component of an acid rain reduction strategy, because energy conservation can almost always be justified on the basis of saved production and capital costs. If, on this basis alone, energy conservation could reduce electric utility fuel consumption by one-third, the costs of acid rain control would be reduced by a more or less proportionate amount. Of course, to the extent that inclusion of conservation as an acid rain control strategy means that utilities can also avoid the costs of acid rain control, the amount of energy conservation or efficiency improvements which would be cost effective will increase. For example, if without consideration to acid rain control costs, a utility can save 2¢ per kWh of production costs and 1¢ per kWh of capital costs, energy conservation which could be implemented for total costs of 3¢ (2¢ operating plus 1¢ capital costs) would be cost effective. If the utility were now required to control sulfur dioxide emission from the power plant and this would impose an incremental cost of .5¢ per kWh, conservation could now be justified up to a total of 3.5¢ per kWh. Thus, designing a control strategy which permits conservation to be an implementation tool will generally increase the amount of cost effective energy conservation. By definition, however, cost effective energy conservation is always less expensive than the alternative of producing power and the resulting acid rain.

This of course may raise the question: if the majority of energy efficiency investments are cost effective without regard to acid rain production, why it is important to include conservation as an available control strategy because conservation should be accomplished even if it were left out of the control strategies selected by Congress? This brings me back to the third element of good regulation which I outlined at the outset-the system of regulation selected should be designed to provide the correct incentives. Substantial amounts of additional energy efficiency improvements are cost effective by any objective measure. Nevertheless, under the current system of economic regulation employed by the state and federal regulators, there is a very strong disincentive to utility implementation of energy conservation or load management practices. I have attached an updated copy of the presentation I gave to the National Association of Regulatory Utility Commissioners Conference on Least Cost Planning in Aspen, Colorado this past April. As that paper points out in detail, cost effective conservation, even conservation at zero cost, is strongly against the utilities' economic interest given the system of regulation we now use. This being the case it is no wonder that a small fraction of the readily available energy efficiency improvements are being obtained by electric utilities. As the tables in the paper point out, a 2% efficiency improvement even at zero cost would reduce the utilities' earned rate of return from 12% to roughly 10.8%. A 2% efficiency improvement at zero cost would not only save all consumers 2% on their bills: it would also reduce acid rain and other undesirable emissions by the same 2%. I point out this contradiction between existing economic regulation of the electric utilities and common sense to highlight the fact that when designing a system of regulation one must be cognizant of the underlying incentives that the regulatory framework will produce. In the case of an acid rain control strategy a framework should be selected which minimizes the emissions of acid rain producing compounds and does so at minimum cost to consumers. It is precisely for these reasons that NARUC's Energy Conservation Committee has endorsed the implementation of acid rain control strategies which give full credit to energy conservation implementation mechanisms. Similarly, NARUC's Energy Conservation Committee is urging the FERC to give energy efficiency a more prominent role in the rules it is now considering for bidding and avoided costs. I have attached a copy of the Conservation Committee's recent position paper urging the inclusion of demand side options in any final rule on bidding.

The third question was, "does an electricity conservation strategy require environmental dispatch of electricty"? The simple answer is no, but changes to the dispatch of power plants will nevertheless result from the implementation of any acid rain emission policy. Moreover, while the environmental dispatch is not required for an energy conservation strategy to work as an acid rain control program, environmental dispatch would certainly increase the contribution that conservation can make.

As you know, the dispatch of electric power generation is controlled by the relative production costs and operational or contractual constraints of each supply source. Thus, anything that affects a power plant production costs or its operational characteristics will change the way the plant is dispatched. For example, an acid rain program targeted to emission rates will change the way power plants are dispatched regardless of whether the emission limit is met through the use of scrubbers or low sulphur fuel. Because low sulphur fuel is more expensive than high sulphur fuel, switching a power plant's fuel source from high to low sulphur fuel will cause it to be dispatched later in a priority order. Similarly, equipping a plant with SO2 scrubbers will also increase the operating costs of the facility which will likewise change the order in which the plant will be dispatched. Other examples of items that affect dispatch include nuclear waste disposal, decommissioning costs which are charged on a production cost basis, fuel related taxes, and other environmental limitations, including thermal emissions and noise. Operational and contractual constraints also affect dispatch functions. Units which are technically dispatchable may be contracted for on a "must run" basis. In addition, day to day mechanical conditions also affect dispatch. I point these examples out to highlight that one should not feel constrained to avoid altering dispatch order when adopting an acid rain strategy.

If an emission control strategy is based upon an emission ceiling, one tool available to the utility to meet the requirement will be to change the order of dispatch. Installing SO2 scrubbers, switching to low sulphur fuels, and purchasing power produced by non sulphur containing fuels and changing the dispatch priorities are all options available to utility to meet the emission ceiling. Thus, making energy conservation a tool which is available to states does not require you to impose environmental dispatch. Instead, environmental disptach would be one of many tools available to utility to meet regulatory constraints.

The fourth question is "is an electricity conservation strategy adaptable to any acid rain legislation"? In particular: (a) does an electricity conservation strategy require that the emissions reductions be expressed as a statewide emission ceiling, e.q. tonnage caps; is such a strategy feasible under a program where the reductions are expressed as emission rate limit? In this area the American Council for Energy Efficient Economy Report does a very good job of laying out the implications of alternative regulatory approaches. I agree with their analysis wholeheartedly. Obviously, this means for the options that have been presented thus far electricity conservation strategy is dependent upon compliance being measured as total emission ceiling. This regulatory approach, while making it possible for energy conservation to become a part of emission strategy, also seems compatible with the underlying purpose of an acid rain control strategy, namely to reduce the total amount of acid rain causing emissions into the atmosphere.

The next part of the question asks that I respond to criticism that emission ceilings constitute a cap on growth. First, setting emission limitations on the basis of a tonnage ceiling only puts a cap on the growth of acid rain producing emissions. It does not by itself constitute a cap on growth of electricity production or energy services. It does imply that if additional growth is to be met by acid rain producing fuels the more growth one experiences the more one has to control other sources to assure that the overall emission ceiling has been met. Because the goal of any acid rain control strategy is to curtail the amount of acid producing emissions put into the atmosphere, this incentive does not seem to be misplaced.

If, however, one believes that the only way to satisfy growth is through the addition of new power plants which emit acid rain producing materials and there are no options available to reduce emissions from other sources, one regulatory approach would be to set an emission ceiling to apply to all existing power plants and an emission rate to all new power plants. Such an approach would still give conservation full credit toward meeting the emission ceiling portion of the state's obligation or also permitting new power plant construction or power purchases to reduce the level of emissions subject to the cap.

To sum up, most of what I am saying today can be reduced to a single proposition: Finding ways to avoid burning fuel to make electricity is almost always cheaper than trying to control the effects of combustion after the fact. The selection of regulatory strategy Congress chooses should take this fact into account.

ATTACHMENT

# Will Least-Cost Planning Work Without Significant Regulatory Reform?

Least-Cost Planning Seminar
National Association of Regulatory Utility Commissioners
Aspen, Colorado
David Moskovitz, Commissioner
Maine Public Utilities Commission
April 12, 1988
(Revised June 10, 1988)

Just when you, like most state regulatory commissions, and other well-informed policy makers are beginning to think that least-cost planning makes sense and has the promise of bringing order to the nation's energy policy, you are about to learn that without significant reforms to the ratemaking system, least-cost planning is going nowhere. To be sure, least-cost planning is off to a reasonably good start in a handful of states. Where it is succeeding, however, it is being accomplished through the brute force and persistence of determined regulatory commissions, or very active state legislatures, or in a few cases, very far sighted utilities.

Least cost planning will not work in most states because it is inconsistent with the type of economic regulation presently used in the electric utility industry. It is very difficult to push a wet noodle uphill. Our current regulatory regime focuses on the price of electricity. Sound least-cost planning requires that we focus on a customer's total bill rather than on price. This seemingly small difference in focus has enormous effects on a utility's investment and planning decisions.

There are, of course, many different systems that states could use to regulate electric utilities and assure reasonable rates for consumers. For example, in the transportation industry there is no such thing as rate base. Instead, this industry was regulated and assured that rates were just and reasonable by using "operating ratios," a simple ratio of revenues to expenses. In many cases, the use of this regulation system produced shockingly high returns on investment. For the telephone industry, many states are now considering other regulatory methods like social contracts. Each regulatory system has its own set of inherent incentives and disincentives. Unfortunately, the system we now use provides very strong disincentives to least-cost planning.

Allow me to present you with some examples, of how existing regulation for electric utilities is inconsistent with sound least-cost planning. Most states have fuel adjustment clauses for their electric utilities which require that fuel and non-fuel revenues be separated for tracking fuel cost recovery. The Maine Commission found that the simultaneous existence of our fuel clause with our newly created time-of-use and seasonal rates produced some perverse economic incentives. In Maine, fuel revenue was booked on the basis of equal cents per kilowatt-hour for every kilowatt-hour sold. As shown in Figure 1, this meant that the non-fuel base revenue was highest for on-peak kilowatt-hours and lowest for off-peak kilowatt-hours. Thus, while our time-of-use and seasonal rates gave customers the proper economic signals to shift use to off-peak periods, our fuel revenue accounting encouraged the electric utility to sell during peak periods because that is when it would earn the greatest profit on each kilowatt-hour sold.* The electric utilities actually had financial incentives to shift off-peak load to on-peak time periods, until we created a new way of accounting for fuel revenue to eliminate this perverse incentive. The effects of our recent accounting orders is shown on the bottom of Figure 1.

The problems caused by existing regulation are much more severe for the proper development of economic demand-side measures. In the current scheme of regulation, utilities make money in only one way - selling kilowatt-hours. Utilities lose money when customers engage in conservation. They likewise lose money when they encourage customers to engage in conservation. This money-losing proposition is not significantly improved by any of the conservation cost recovery or incentive mechanisms now in use. Figure 2 shows a typical situation in the United States today where a customer pays about 7¢ a kilowatt-hour for electricity and the utility has a short run production cost of 3¢ per kilowatt-hour. For each kilowatt-hour saved, the utility's revenues go down by about 4¢ and its costs go down by 3¢. With a fuel adjustment clause, the 3¢ fuel savings flows through to customers and, thus, the kilowatt-hour saved by a customer will deprive the utility of 4¢ of non-fuel revenue.

Figure 3 shows what happens to the return on equity of a typical utility when it achieves a 2% efficiency improvement for its customers at three levels of cost: zero cost, 50% of avoided cost and 90% of avoided cost. All of these cases assume full recovery of the utility's out-of-pocket costs to achieve the conservation. In each case, the utility's equity earnings dropped from 12% to 10.8%. They lose revenue. They lose profit. This is the reality of our ratemaking process. The only way to restore earnings to a reasonable level is to initiate a rate case - a solution which is not attractive to utilities, nor will it improve past loses. Furthermore, rate cases driven by utility implementation of cost effective efficiency improvements will not endear customers to the idea that efficiency improvements are a good thing. There is no incentive for the utilities to encourage demand side measures and every incentive not to encourage them, except perhaps as an appeasement to their commissions. This I believe, will be a short-lived response and not a very robust response.

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* While non-fuel base revenues recover many costs other than profits, those costs are not variable in the short run and thus incremental base revenues flow almost directly to bottom line profits.

We need a cost recovery or incentive mechanism that overcomes this very strong financial incentive against sound least-cost planning. Figure 3 shows that full cost recovery for conservation expenses on a current basis is inadequate. Figure 3 also shows that ratebasing of conservation produces less than $1 million, which doesn't approach offsetting lost revenues of $5.8 million. Figure 3 also shows that ratebasing of conservation plus a premium return on equity for conservation does not make a significant difference.** Even if one approaches conservation on a shared savings basis or establishes an unregulated subsidiary of an electric utility to perform conservation, the overwhelming financial incentive will be to sell kilowatt-hours as opposed to conserving kilowatt-hours. The sad fact is, that even zero-cost conservation is strongly against the utilities' own financial interests.

The California Public Utilities Commission has established a sales adjustment to their existing system of regulation, which goes part way toward neutralizing the disincentive to least-cost planning. The California approach decouples profits from sales, but it still provides no incentive to engage in conservation or, for that matter, to reduce customer bills by cutting costs.***

Roughly six months ago, the Maine Commission challenged Maine utilities to present ideas for alternative systems of regulation or reforms to the existing ratemaking system that would make least-cost planning consistent with the utilities' economic interest. We asked them, and anyone else we could collar at NARUC or other meetings, to devise a system that would make 2¢ conservation more profitable than 3¢ energy supply. We were seeking a system that would make: 3¢ conservation and 3¢ energy supply equally profitable, 1¢ conservation more profitable than 2¢ conservation, and 1¢ supply more profitable than 2¢ supply. We wanted a system that would cause the utilities to use supply or demand options when they were most economic.

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** To make matters worse, under existing rate regulation supplemented with rate basing of conservation costs, the best conservation investments from a utility's profitability perspective are very expensive and ineffective conservation. Maximizing investment and minimizing sales erosion are the incentives of this combination rate treatment.

*** California's ERAM adjustment has been in place for many years and has yet to be adopted by any other state. One reason may be the highly unattractive aspect of ERAM which has rates increase if people conserve and sales go down. While rates increase an equal amount under the proposed plan, they increase only if the utility has out-performed its counterparts in the index.

We wanted a system that made utility profitability consistent with least-cost planning. It is our belief that a system of regulation which harmonizes the utilities' economic interests with those of consumers, would yield quicker and better results than heavy-handed regulation.

The system had to be simple to administer and, above all, it had to be understandable to the average consumer. Any system of complex equations or questionable performance measures would not gain public support, which would be necessary if significant changes to our regulatory systems were to be made. The system also had to be fair, meaning that it would not reward or punish the utility for matters entirely outside their control. The system had to assure that superior performance yielded superior returns.

Sadly, no one came forward with any suggestions. On the bright side, however, a few weeks ago we began informal discussions with interested persons about a ratemaking change that may accomplish our desired goals. I have proposed a system which ties a utility's rate of return to relative improvements in average bills for residential customers, and in electricity bills per square foot of floor space for commercial customers. I cannot over-emphasize the importance of focusing attention on average customer bills and not on average prices of electricity. I proposed that a base period be established for average bills for Maine's electric utilities and for an index comprised of the average bills of all utilities in the New England region. On a periodic basis, probably April of each year, Maine electric utilities' rates of return would be adjusted up or down, perhaps capped at plus or minus 2 percentage points, depending on the relative performance of their average customer bills compared to the index. To avoid gamesmanship, the system would have to be in place for at least five years, preferably longer. Tying to an index of other utilities quickly became the heart of the proposal. This provided a simple way to control factors like weather, economic conditions, and fuel price changes without resorting to more complex measures.

As a group, utilities in the New England region are subject to the same general economic conditions, weather, and fuel prices as utilities in Maine. While the average level of rates among New England utilities varies considerably, the rate of change of Maine utilities and the group of other New England utilities has not changed significantly over the last ten years. Under this proposal, CMP's rate of return will depend in part on the Company's ability to cause this historic pattern to change.

Because this system focuses on relative changes in average customer bills, not rates, it will assure that 2¢ conservation will be preferred to 3¢ supply. This is because the cheaper option, regardless of its impact on rates, has a greater effect on lowering customer bills. Indeed, even for a utility with enormous amounts of excess capacity, efficiency gains that cost less than the running cost of existing plants will lower customer bills, thereby assuring the utility higher than average profits. Finally, by focusing on customer bills rather than only on prices, we are better able to match our regulatory priorities with our ratemaking process.

This system is simple to understand. It is oriented to the bottom line which is easily compared and measured. There is no need to measure the cost or actual performance of conservation or other demand-side management efforts since all program savings and program costs will be reflected in the average customer bills.

Anything the utility can do to lower costs - cost-effective conservation, cost-effective supply, or any other cost-cutting measures - will now be in the utility's interest. This system is equally weighted on supply and demand options and means $1 saved produces the same effect regardless of how it is saved. Morever, many measures which are not generally included in electric utility conservation efforts could now be very attractive business opportunities. Most important among these is that cost effective fuel switching under this system is, for the first time, in the utility's economic interest. There may be enormous benefits to consumers and utility stockholders in this area.

The system is likely to gain substantial public understanding and support. As shown in Figure 5, a 2% reduction in average customer bills would require about a 1.8% increase in the utility's rate of return making low-cost demand measures more profitable than higher cost supply. Sharing average bill savings in this way will assure that both ratepayers and utilities benefit from cost-effective conservation. Figure 5 shows some typical scenerios.

On the negative side, like all new approaches, it has problems that must be addressed. The 2 percentage point positive or negative change of the company's rate of return provides up to a 4 1/2 percentage point change in the return on equity. This is not a large change (positive or negative), but for customers that are unable to realize savings, it may be more than they are willing to pay. Figure 4 shows a worst case scenario for how such a system would affect non-participants. As this figure shows, a 2% efficiency gain, which is a sizeable gain, would increase prices by just under 2% including the incentive payment to the utility. This 2% price impact is a worst-case example because it assumes very expensive demand-side programs and it further assumes that the customer who receives the benefit pays nothing directly.

Another difficulty is the selection of the right index. This includes questions such as: Which utilities? Which customers? Over what time period? In addition, should adjustments be made for abnormalities in order to assure that a targeted electric utility neither profits nor loses due to unrelated matters to its relative performance? Finally, because this incentive mechanism will encourage utilities to cut costs in all areas, we want to be sure that important areas like customer services and quality of service do not suffer.

A number of interested persons in Maine and elsewhere have joined in discussions concerning this proposal. So far we have uncovered no fatal flaws and all groups have reacted positively. If this trend continues, the Commission will institute a formal proceeding which may result in the implementation of this system or in another system which better meets our goals.

If we believe that least-cost planning is a desirable goal, we must be willing to reform regulation to make it consistent with least-cost planning. If we make the needed changes, least-cost planning will quickly become a reality and we will never again hold conferences to discuss the meaning and merits of least-cost planning.

This proposal has now been the subject of many hours of review by many groups and individuals. Through this process we have identified a group of frequently asked questions. These are set forth below with appropriate answers.

1. Will this system also have the undesirable effect of discouraging the use of new and efficient electricity-consuming devices?

Under this system, if customers add new electricity-consuming devices, even efficient ones - VCR, microwave oven, etc., use per customer and therefore customer bills will increase. All else equal, the introduction of such devices continues to be in the utilities' interest. Of course, all else is never equal. In particular this scenario is only a problem if you assume that consumers elsewhere are not buying and using the same new technology. Thus, under this system utilities would be discouraged from promoting the use of new electricity devices to a degree that exceeds the pace at which the same devices penetrate the market for utilities in the index. Because there is little chance that a new device will be available only in the territory of the target utility, there is little likelihood of harm to the utility. Of course, under this system the utility target would have an incentive to encourage the use of the most efficient models of the new device.

Finally, these incentives must be compared to the incentives inherent in existing ratemaking practice. Under existing regulation, utilities have an incentive to encourage sales including the use of electricity guzzling gadgets, even in the face of more cost-effective ways to meet the end use.

2. Will utilities encourage customers to engage in non-cost effective conservation?

Under any system of regulation utilities could engage in unreasonable or imprudent actions. This system is no different. Under existing regulation, utilities would profit from undetected efforts to unreasonably promote consumption. Under the proposed ratemaking system, utilities would profit from undetected efforts to encourage non-cost effective conservation. Both are equally imprudent. My feeling is that the latter would be less likely to occur, easier to detect, and less likely to lead to the type of massive prudence disallowances that have been apparent in the last decade.

3. What effect will weather, economic conditions, and fuel price changes have under this system?

One of the fundamental features of any desirable ratemaking system is that utilities neither benefit nor are harmed by factors outside their control. Under current ratemaking practices utilities are nevertheless affected, and in some cases affected to a significant degree by economic conditions and weather. Thus a summer peaking utility will experience very high profits if the summer is unusually warm and vice versa. The same is true for the influence of an unusually strong or weak economy.

On the other hand, utilities are now generally held harmless (positive or negative) from fuel cost (or fuel quantity or mix) changes. Indeed, in many respects they are insulated from factors such as heat rates and unit availability, factors more in their control than most.

4. Isn't it impossible to get the right index?

The important features of the index are that as a group (as opposed to each individual utility within the group) the following features are present:

a) The index utilities are subject to the same general economic conditions. This does not mean that the level of economic health be equal, only that if the index is experiencing economic growth, so is the target utility.

b) The index should be subject to the same general weather conditions. Again, degree days don't have to be the same but if the index is experiencing a hot summer relative to its normal condition, so is the target utility.

c) The index group should have the same fuel mix (or at least the same oil mix) as the target utility at the outset of the rate scheme. This will assure that the target utility is reasonably protected from fuel cost changes.

As explained in the previous question and answer, precision is not an important element of the index. Even if the index is only marginally accurate, it will serve to relieve the target utility of risks which it is exposed to now. Thus, where a utility is now entirely at risk for weather patterns, it will be only at risk for differences in weather patterns. Reducing these factors to second order of importance is a desirable feature of the plan.

5. Won't this plan provide utilities with an incentive to allow maintenance to deteriorate?

Under the proposal, the existing incentives to cut maintenance will be diminished compared to existing ratemaking practices. Under existing ratemaking, maintenance depreciation which impacts plant performance generally results in higher fuel costs, higher heat rates, more outages with higher replacement power costs which are then passed on to customers. Unless, of course, the Commission is able to detect the practice and penalize the utility. Under the proposed plan, these higher fuel cost charges affect customer bills and will automatically reduce the utilities' rate of return.

In all other respects, the propensity of utilities to cut maintenance is the same under the proposed plan as it is under existing procedures. Detection of utility imprudence in this regard is also unaffected.

6. Will utilities have an incentive to discourage new customers from moving into their service territory?

To the extent that new customers are more efficient than existing customers (new houses have more insulation, etc.), adding customers will be in the utilities' interest. Adding inefficient customers would not be in their interest. Of course, under existing ratemaking, adding any customer is in their interest.

The addition of new customers residential or commercial, is not something that utilities are likely to be able to influence, even if they try.

7. Would it be easiest to make money under this plan for those companies who have done the least in the past?

There is no sound policy objective for this or any other incentive scheme to create an environment in which it is equally easy for all companies to make (or lose) money. Thus, even if the premise of the question were true, it should be of little importance to state regulators.

# FIGURE 1

## BEFORE

| | ON PEAK | OFF PEAK |
|---|---|---|
| Price | 10¢/KWH | 5¢/KWH |
| Fuel | 4¢ | 4¢ |
| Non-Fuel | 6¢ | 1¢ |
| Contribution to Fixed Costs and Profits | 6¢ | 1¢ |

## AFTER

| | | |
|---|---|---|
| Price | 10¢/KWH | 5¢/KWH |
| Fuel | 7¢ | 1¢ |
| Non-Fuel | 3¢ | 4¢ |
| Contribution to Fixed Costs and Profits | 3¢ | 4¢ |

# FIGURE 2

| | |
|---|---|
| PRICE | 7¢ |
| MARG. FUEL COST | - 3¢ |
| LOST UTILITY REV. | 4¢ |

# FIGURE 3

## 2% Efficiency Improvement

| | Base | Case 1 | Case 2 | Case 3 |
|---|---|---|---|---|
| Cons. Cost | | 0 % | 50 % | 90 % |
| Revenue ($MM) | 500 | 490 | 492.1 | 493.78 |
| Sales GWH | 7000 | 6860 | 6860 | 6860 |
| Earned Return | 16.0 % | 15.2 % | 15.2 % | 15.2 % |
| Equity Return | 12.0 % | 10.8 % | 10.8 % | 10.8 % |
| Return Def. ($MM) | 0.00 | 5.80 | 5.80 | 5.80 |
| Cons. Cost ($MM) | 0 | 0 | 2.1 | 3.78 |
| Rate Base Con. | 0.00 | 0.00 | 0.34 | 0.60 |
| Rate Base + 2% | 0.00 | 0.00 | 0.38 | 0.68 |
| Remaining Revenue Deficiency ($MM) | 0.00 | 5.80 | 5.42 | 5.12 |

# FIGURE 4

## ASSUME 2% EFFICIENCY GAIN

## Conservation Cost
## 90% of Avoided Cost

| | |
|---|---|
| OLD RATE | 7.143¢/KWH |
| NEW RATE | 7.283¢/KWH |
| DIFFERENCE | 1.9% |

See figure 5 for detail.

## FIGURE 5

| Assume: | | |
|---|---|---|
| | Rate Base | 750 Million $ |
| | Expenses w/ fuel | 380 Million $ |
| | ROR | 16%Incl tax |
| | Sales | 7000 GWH |
| | Customers | 400 Thousand |
| | Marg Cost | 0.03 $/KWH |
| | Base Revenue | 0.04143 $/KWH |

| Conserv %<br>Conserv Cost (% of AC) | Base<br>Base | 2%<br>0% | 2%<br>50% | 2%<br>90% | 2%<br>100% |
|---|---|---|---|---|---|
| Revenue ($MM) | 500 | 490 | 492.1 | 493.78 | 494.2 |
| Sales (GWH) | 7000 | 6860 | 6860 | 6860 | 6860 |
| Avg Bill ($) | 1250 | 1225 | 1230.25 | 1234.45 | 1235.5 |
| Avg Rate ($) | 7.143 | 7.143 | 7.173 | 7.198 | 7.204 |
| Earned Return | 16.0% | 15.2% | 15.2% | 15.2% | 15.2% |
| Equity Return | 12.0% | 10.8% | 10.8% | 10.8% | 10.8% |
| Return Def ($MM) | 0.00 | 5.80 | 5.80 | 5.80 | 5.80 |

| | | | | | |
|---|---|---|---|---|---|
| New Rate * | 7.143 | 7.227 | 7.258 | 7.283 | 7.289 |
| New Avg Bill ($) * | 1250 | 1240 | 1245 | 1249 | 1250 |
| GWH Saved | 0 | 140 | 140 | 140 | 140 |
| MC Saved ($MM) | 0 | 4.2 | 4.2 | 4.2 | 4.2 |
| Conserv Cost ($MM) | 0 | 0 | 2.1 | 3.78 | 4.2 |
| Rate Base Con ($MM) | 0.00 | 0.00 | 0.34 | 0.60 | 0.67 |
| Rate Base + 2% ($MM) | 0.00 | 0.00 | 0.38 | 0.68 | 0.76 |
| Remaining Ret Def ($MM) | 0.00 | 5.80 | 5.42 | 5.12 | 5.04 |

'* Includes full recovery of conservation costs
plus return deficiency

ATTACHMENT

# NARUC Energy Conservation Committee Paper on Demand Side Bidding and Preemption Issues in the Recent FERC NOPRs

The Notice of Proposed Rulemaking for Regulations Governing Bidding Programs issued by FERC on March 26, 1988 requests comment as to whether demand side management (conservation) options should compete directly with all other sources in bidding programs for the purchase of capacity. This paper prepared by the NARUC Committee on Energy Conservation discusses why demand side options belong in bid systems and describes the experience of one state which has already incorporated demand side options in their PURPA bidding programs. Further, it discusses the preemption problems raised by the NOPR's and their relationship to demand side bidding.

## The Case for Demand Side Bidding

At the outset it is important to note that FERC expressly recognizes that states may properly consider demand-side alternatives to capacity expansion[1]. The validity of demand-side measures as a means of meeting capacity needs that would otherwise exist has been broadly recognized by most state commissions and is reflected in the large number of utility sponsored conservation programs now in place throughout the country. The very desirable characteristics of the conservation option i.e., flexibility, short lead times, most effective during periods of greatest demand, reducing uncertainty in load forecasting and close match between increments of capacity and growth in demand, require its inclusion in resource planning.[2] The question raised by the FERC NOPR on the bidding process is whether conservation ought to be included on the same basis as all other sources of supply in bidding programs. The NARUC Energy Conservation Committee believes that not only can demand side measures be included, they must be included if bidding programs are to produce the least cost sources of capacity.

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[1] Section III, E, a, at page 57, FERC Notice of Proposed Rulemaking for Regulations Governing Bidding Programs, Docket No. RM88-5-000.

[2] These characteristics are identified and more completely discussed in the testimony of Ralph Cavanagh on All Source Bidding Systems before the House Energy and Commerce Committee's Subcommittee on Energy and Power, March 31, 1988, at pages 3-4.

There are special considerations which need to be addressed when comparing demand side purchases to supply side options. However, these considerations exist whenever conservation is purchased and remain the same whether or not a bidding system is used. Once these concerns are addressed, there is no reason not to purchase cost effective demand side management or to include it in bidding processes.

There are essentially three issues that must be addressed. First, cost effectiveness must be defined to include all demand side measures that cost less than the utilities avoided cost. Second, the computation of the cost of the demand side program or the "bid" price of demand side measures must include any contribution made by the participant. Thus, a lighting program that is bid to the utility at 2¢ per kilowatt hour but also charges the customer the equivalent of 1¢ per kilowatt hour is considered to be a total bid of 3¢ per kilowatt hour. Along this same line, those proposed programs which have a great portion of their costs picked up by participants ought to be favored and ranked higher in any bid or other purchase analysis over those programs in which participants make a smaller or no contribution. Thus, using the same example, the 3¢ program described would rank higher in a bidding system than a proposal that bid the entire 3¢ to the utility and charged the participant nothing. This ranking mechanism minimizes non participant and "free rider" effects. Lastly, the end use must be held constant when comparing supply and demand sources. Thus, customers would receive no payment for lowering thermostats, turning lights off or shutting down production lines. Imposing a constant end use criteria eliminates many of the opportunities for gamesmanship. The customer must receive the same amount of drive, light, comfort or other end use as achieved using a supply source. Finally, matters such as ability to measure demand side performance must be a factor in ranking demand side bids. Again, these concerns must be addressed when making any demand side or conservation purchase. They are not unique to bidding programs.

The most compelling reason for including conservation in bidding is that it is the simplest, most effective way of identifying and implementing demand side resources. It is also the simplest, most effective way of assuring ourselves and our ratepayers that the price paid for new capacity is the least possible. Because demand side measures also generally cost less than supply side alternatives, inclusion of both sources will tend to drive supply side bids down to cost. Failure to include demand side measures in bids (or alternatively to include all cost effective conservation in administratively determined avoided cost) will assure that too high a price is paid to supply side resources.

The Maine PUC approved the integration of demand side management into PURPA bidding in November 1987 when it authorized Central Maine Power Company's Power Partners Program.[3] By way of background, the avoided cost methodology used in Maine requires the annual filing of a fifteen year load forecast and optimized energy resource plan. Once established, 50 MW decrements at a time are backed out of the resource plan, the most expensive capacity first. Bids are solicted for purchases not to exceed the calculated avoided costs of each decrement. Central Maine Power Company has generally solicited bids for two 50 MW decrements at a time.

Central Maine Power's first request for proposals including the conservation demand side management bid option was issued in December, 1987 with a February 9, 1988 submission deadline. The two decrements offered had calculated avoided costs of 5.12 and 4.97 cents per kilowatt-hour, respectively, levelized over 15 years. Thirteen conservation bids were received among a total of 32 bids. The thirteen bids, which totaled more than 35 MW included proposals as small as .053 MW to as large as 10 MW. The proposals included residential programs as well as commercial and industrial programs. [4] The bidders included third party providers and customers. Bidders also included firms which had successfully bid and received small power (hydro) contracts in earlier decrements.

Central Maine Power Company has ranked all 32 bids received during this round of bidding and has commenced negotiations. The eight highest ranking projects as of April 25, 1988 were conservation projects and 13 of the top 15 ranked projects were

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[3] Even prior to the creation of the competitive bidding option for demand side measures, Central Maine Power Company received a conservation bid in response to an April, 1987 request for proposals.

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[4] The breakdown for bid programs by class are as follows:

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| residential | 10 MW |
| commercial | 10 MW |
| industrial | 5 MW |
| commercial/industrial | 10.5 MW |
| Total | 35.5 MW |

Projects included installation of energy efficient lighting, changeover of manufacturing process and residential retrofit packages.

conservation proposals[5/]. The average bid price for conservation proposals were 69% of avoided cost compared to 96.5% for supply side options. This result evidences substantial, cost-effective demand-side opportunities are available which have little trouble competing with supply side proposals in this newly created market.

The strength of the bids offered and the breadth of the projects which provide participant benefits to all customer classes foretell a vigorous market for demand side management capacity sources. Having had similar success earlier on with the development of a vigorous cogeneration market through the use of bidding, the Maine Commission is pleased with the conservation response to this first round of true all source competitive bidding.

## Concerns Regarding Preemption and Demand-side Measures

When the NOPR on administrative-determination of avoided cost was issued in March, the heavily-criticized proposal for a single avoided cost for multistate utilities had been removed, allowing state regulators a sigh of relief. In its place was a seven-page discussion (Docket No. RM88-6-000, pp. 67-74) of the multistate utilities issue, in which FERC solicited comment on how "multistate utilities should be defined." (p. 73) The Commission declared that it would not require the observance or establishment of a single system-wide determination of avoided cost for such utilities "until a clear showing that different state determinations could create serious problems for the efficient operation of multistate systems...." (Id.)

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[5/] The rankings do sometimes change during negotiations as project details become more explicit.

On April 14, however, FERC did a bellyflop into the then-calming waters of its rulemaking process. Without waiting to receive the just-solicited comments on how to define multistate utilities, the Commission issued a decision in Orange and Rockland Utilities, Inc., (Docket No. EL87-53-000), in which it invalidated on federal preemption grounds New York State's legislatively-enacted six cent per kWh avoided cost rate for purchases from cogenerators and small power producers. In so doing, FERC sounded a warning that its new policy of preemption in this area would not be limited to "multistate utilities" such as Orange and Rockland, declaring:

> Under our new position, states cannot in the future impose rates exceeding avoided cost on purchases by either multistate utilities such as the O&R system or utilities that operate exclusively in one state. Under Florida Power & Light [404 U.S. 453 (1972)], a purchase by any utility is a transaction in interstate commerce as long as the purchased electricity enters on an interstate transmission grid.

(Orange and Rockland at p.22, Emphasis added.)

Coupled with FERC's traditional assertion of jurisdiction over sales of electricity for resale in interstate commerce under Section 205 of the Federal Power Act, the Orange and Rockland decision strongly implied that FERC now views its authority to preempt state avoided-cost determinations as plenary throughout the United States (with the possible exception of transactions taking place entirely in certain states, e.g., Hawaii, Alaska, and portions of Texas). See Docket No. RM88-5-000, p.29 at fn 55.

At the very least, states should be concerned that FERC may move in the direction of preempting any state actions that can be viewed as intefering with power pooling and the efficient operation of the interstate grid. While this concern is evident in Orange and Rockland, it is also apparent in the language of the NOPRs, wherein FERC "recognizes the possibility that the problems that may arise for utility systems subject to multiple state regulation could be aggravated by uncoordinated state bidding programs." See RM88-5-000 at p. 79 and RM88-6-000 at p. 69. FERC's sensitivity to possible disruption of integrated-system planning and operation is expressed several times in the Avoided-cost NOPR. There, the Commission expresses concern that such disruptions may increase if, for example, states regulating multistate integrated utilities or utilities operating in more than one state make differing avoided cost determinations.

Similarly, FERC suggests that disruption may occur if one state opts to use a bidding system, while another state regulating the same multistate utility elects to administratively determine avoided costs. Finally, and of particular concern to the Conservation Committee, FERC foresees problems if regulatory authorities in different states adopt or emphasize different demand-side programs for the same multistate utility. *See* RM88-6-000 at pp. 69-72.

FERC also approvingly (and somewhat ominously) recites the argument made by holding company commenters in the 1987 regional comments on the PURPA and avoided costs that any integrated system that is centrally planned and dispatched has only one avoided cost and that "*[this] reasoning would seem to carry over to single corporate entity utilities that operate in more than one state, and may also apply to 'tight' power pools of unaffiliated companies.*" *Id.* at 71, emphasis added.)

Thus, there are ample reasons stated in the NOPRs themselves to arouse concern that preemption has spilled out beyond the bounds of FERC's multistate and power pool jurisdiction (as exercised in the *Middle South* and *AEP* cases so familiar to state regulators) to include all electric utilities which touch interstate commerce and that FERC may employ preemption to restrict or even prohibit states from incorporating demand-side elements into bidding programs.

These concerns are also fueled by speeches and pronouncements made by FERC Commissioner Charles Stalon, who at one point shortly before the NOPRs were issued suggested that the Commission ought to consider "do[ing] everything to discourage such actions short of banning" the inclusion of demand-side measures in bidding programs. *See* Memorandum from Commissioner Stalon to FERC Commissioners regarding "The Role of 'Conservation' Programs in the Bidding NOPR (RM88-5)", March 4, 1988.

Commissioner Stalon has been the principal and very articulate proponent at FERC of the theory of "economic efficiency" in utility regulation. Should a majority of the Commission decide to build upon *Orange and Rockland* and advance Stalon's view that FERC has a "clear mandate to encourage coordination and efficiency-furthering nonmarket integration between utility systems, i.e., to encourage power pools and integrated planning of the type that approach their zenith in the multistate holding companies such as *Middle South* and *AEP*", then states must be prepared for additional preemptive actions by FERC when the NOPRs are finalized. *See* "Electricity in Transition: ; The Evolving State/Federal Partnership", Speech by Commissioner Stalon at the First Annual Conference on Electricity Law and Regulation, Denver, Colorado, April 8, 1988, at p.5.

In conclusion, it must be acknowledged that FERC has shown little real enthusiasm for demand-side opportunities. The Bidding NOPR devotes only one short paragraph to a discussion of Demand-Side Alternatives (p. 57), concluding with a request for comment on "how demand-side options should be considered; i.e., whether they should compete directly in bidding or whether there are other ways to take them into account." (Emphasis added.) This final clause is distrubing in the light of FERC's historic lack of interest and experience with conservation and demand-side alternatives.

The states should urge FERC to greatly increase the flexibility with which states may adopt and implement bidding programs, removing the preemptive aspects and allowing states to continue the innovative experimentation which has already worked so well to this point.

Mr. SHARP. Thank you, Mr. Moskovitz. Mr. Prendergast.

### STATEMENT OF JON T. PRENDERGAST

Mr. PRENDERGAST. Thank you, Mr. Chairman, members of the subcommittee. I am Jon Prendergast, Manager of Utility Relations for LTV Steel Company.

I'm testifying here today on behalf of the American Iron and Steel Institute [AISI] whose 43 domestic members account for over 80 percent of the raw steel production in the United States, and themselves are large users of energy which constitutes more than 20 percent of their manufacturing costs.

AISI appreciates the opportunity to appear here today to offer our comments in the role of conservation in a national acid rain policy.

On load management, steel companies, like most industrial users of energy, normally are high load factor customers of the utilities.

They use energy, including electric energy, more or less continuously 24 hours a day, 7 days a week, and 365 days a year. By virtue of this fact, they provide the utility with a customer that is lower cost to serve, one for which the electric utility can use its lower cost based generation facilities.

In addition, most large steel companies manage their electric costs with sophisticated load management systems which cut back on steel operations or call for the increased use of self-generation when consuming power above a pre-determined level.

On conservation, all of the major steel companies have active energy conservation programs. AISI's energy conservation reporting system was in place in the early 1970's, long before the DOE instituted its industrial energy conservation program.

In 1972, when AISI first began its program, member companies reported that energy consumption of more than 32 million Btu's was required to produce a ton of shipped steel.

That number for 1987 was just above 22 million Btu's, a 32 percent reduction from 1972. Since 1980 alone, steel companies have reduced their energy use per shipped ton by 25 percent.

On cogeneration, the steel industry was one of the pioneers in the field of cogeneration. Our use of cogeneration dates back to the turn of the century.

The blast furnace process, the means by which oils reduce to iron, lends itself naturally to cogeneration by virtue of the large amounts of byproduct gases generated, enormous steam requirements necessary to generate wind and corresponding large steam and electric requirements in the steel-making and rolling areas of our plants.

In some cases, our present powerhouses generate an equivalent amount of power as many small utilities. What does all this mean?

First of all, the steel industry has spent a great deal of money, time, and effort to reduce its energy consumption and, therefore, its costs.

Steel companies have ongoing conservation programs and goals. AISI does not believe, however, that a reduction in the 14 percent range in overall electric power use, as suggested in the ACEEE study, is economically possible in our industry in the absence of further restructuring leading to downsizing or closing of facilities causing reductions of personnel.

Most of the obvious reductions in energy use have already been accomplished. Some of those reductions have been accomplished with modernization, but some reductions have been accomplished by closing older, inefficient plants.

What gets accomplished in reducing energy use from this point is likely to be extremely costly. Second, the steel industry has taken great pains to reduce its energy costs in order to become more competitive in the world markets where it now finds itself.

The steel industry lost over $12 billion from 1982 through 1986. And the recent profits it has experienced do not begin to offset that loss.

Moreover, it's imperative that we invest what profits there are back into the modernization of our facilities. This must be accomplished if we are to thrive.

Quality and cost of our products is what customers key on, with quality assuming an increasingly important role. The role of electricity in this endeavor to produce a quality product is becoming exceedingly more important. From 1980 through 1987, while our overall energy consumption decreased, electricity use by steel companies as a percent of shipped tonnage actually increased.

Our efforts to upgrade facilities included new electrogalvanizing lines to produce corrosion resistance steels and include ladle metallurgy facilities with electric arc reheaters to produce high grade steels.

Electric arc furnaces is a means of melting steel scrap in lieu of the more facility capital-intensive blast furnace-coke plant alternative, also increases electricity consumption.

Moreover, this modernization of our facilities is likely to consume the majority of our profits with other projects, including conservation, vying for the remaining available capital.

Projects with paybacks greater than 1 year, therefore, will probably not get accomplished if the sole benefit is conservation without any other considerations such as enhanced quality or production.

The acid rain bills which have been the focus of legislative action thus far, impact the steel industry in three significant ways.

One, electric rates will increase. Two, industrial boilers will be covered by the bill's emission reduction plans. And three, the Waxman Bill extends a coverage to industrial process emissions.

First, the increase in electricity rates charged by utilities will severely impact an industry as electric intensive as steel and the rigid emission rate, even the tonnage reduction, will be extremely costly to industry.

For the steel industry alone spends in excess of $1.5 billion yearly on electricity. The increased energy costs imposed by these bills could be devastating.

The combined $NO_x$-$SO_x$ provisions would result in increased steel industry costs of about $700 million per year. Second, the bill's provisions extend emission control provisions directly to industrial boilers.

$SO_2$ emissions from industrial boilers account for less than 10 percent of the total $SO_2$ emissions in the United States and are decreasing each year.

Third, the Waxman Bill extends a State emission reduction plan's coverage to industrial process emissions. The total effect of these provisions in electric intensive industries such as steel will be felt primarily in the Midwest, where the majority of our facilities are located.

The effects will include the potential for shifting production to other locations and employee layoffs. Finally, it should be pointed out that a better approach for dealing with the $SO_2$ emissions from electric utilities can be achieved by greater use of industrial cogeneration, electric power generated by IPP's, and importation of hydropower from neighboring Canada.

However, these alternatives can be tapped only if access to the electric power transmission grid, wheeling, is made possible.

Industrial interests, including AISI, are urging the FERC to provide transmission access to cogeneration facilities and independent power producers in FERC's current rulemaking dockets on competitive bidding for bulk power markets.

In conclusion, acid rain bills impose significant cost increases on energy intensive industries such as the steel industry and such costs cannot readily be reduced through conservation.

We've done a lot in the past, but from here on out it's going to get much, much more difficult. As to the steel industry's Midwest facilities, they will either compete in the world market or their operations will be reduced.

I thank you for the opportunity to be here to make the statement and would be happy to answer any questions.

[The prepared statement of Mr. Prendergast follows:]

## Statement of Jon T. Prendergast, LTV Steel Company

I am Jon Prendergast, Manager of Utility Relations for LTV Steel Company. I am testifying today on behalf of the American Iron and Steel Institute ("AISI"), the principal trade association of the domestic steel industry. AISI's 43 domestic members account for over 80% of the raw steel production in the United States, and are large users of energy, which constitutes more than 20% of our manufacturing costs.

AISI appreciates the opportunity to appear today to offer our comments on the role of conservation in a national acid rain policy. At the outset, let us state categorically that AISI is vigorously opposed to pending acid rain legislation because of the lack of scientific evidence to justify the devastating economic impact it would have on our industry.

With that important caveat, we will, for purposes of discussion, address the subject of today's hearing as three categories - load management, conservation and cogeneration.

### Load Management

Steel companies, like most large industrial users of energy, normally are high load factor customers of the utilities. By this we mean that they use energy, including electric energy, more or less continuously 24 hours a day, seven days a week and 365 days per year. By virtue of this fact, steel companies provide the utility with a customer that is lower cost to serve, one for which that electric utility can use its lower cost base generation facilities. Where steel companies do use electric energy in a non continuous manner, such as for electric arc furnaces, they do so usually on an interruptible basis. An interruptible customer is served by the excess capacity of a utility and can be called on by the utility to curtail that use whenever supply to the utility's other customers is threatened. In addition, most large steel companies manage their electric costs with sophisticated load management systems, which cut back on steel operations or call on the increased use of self-generation when consuming power above a predetermined level.

### Conservation

All of the major steel companies have active energy conservation programs. AISI's energy conservation reporting system was in place in the early 1970's, long before the DOE instituted its industrial energy conservation program. In 1972, when the AISI first began its program, member companies reported that energy consumption of more than 32 Million BTUs was required to produce a ton of shipped steel. That number for 1987 was just above 22 million BTUs, a 32% reduction from 1972. Since 1980 alone, steel companies have reduced their energy use per shipped ton by 25%

## Cogeneration

The steel industry was one of the pioneers in the field of cogeneration. Our use of cogeneration dates back to the turn of the century. The blast furnace process, the means by which ore is reduced to iron, lends itself naturally to cogeneration by virtue the large amounts of by-product gases generated, enormous steam requirements necessary to generate wind and corresponding large steam and electric requirements in the steelmaking and rolling areas of the plants. In some cases our present power houses generate an equivalent amount of power as many small utilities.

## Energy Consumption and Costs - The Steel Industry's Record

What does all of this mean? First of all the steel industry has spent a great deal of money, time and effort to reduce its energy consumption and, therefore, its costs. Steel companies have ongoing conservation programs and goals. AISI does not believe, however, that a reduction in the 14% range in overall electric power use, as has been suggested in Acid Rain and Electricity Conservation by the American Council for an Energy Efficient Economy, is economically possible in our industry in the absence of further restructuring, leading to downsizing or closing of facilities causing reductions in personnel. Most of the obvious reductions in energy use have already been accomplished. Some of those reductions have been accomplished with modernization, e.g. continuous casting has eliminated a reheating process and has increased yield, but also some reductions have been accomplished by closing older inefficient plants. What gets accomplished in reducing energy use from this point is likely to be extremely costly.

Second, the steel industry has taken great pains to reduce its energy costs in order to become more competitive in the world markets where it now finds itself. If we are required to subsidize other ratepayers to conserve electric energy, we will be disadvantaged further. The steel industry lost over $12 billion from 1982 to 1986 and the recent profits it has experienced do not begin to offset that loss. Moreover, it is imperative that we invest what profits there are back into the modernization of our facilities. This must be accomplished if we are to survive. The quality and costs of our products is what customers key on, with quality assuming an increasingly important role.

The role of electricity in this endeavor to produce a quality product is becoming exceedingly more important. From 1980 to 1987, while our overall energy consumption decreased, electricity use by steel companies as a percent of shipped tonnage actually increased. Our efforts to upgrade facilities include new electrogalvanizing lines to produce corrosion resistant steels and ladle metallurgy facilities with electric arc reheaters to produce high grade steels. Electric arc furnaces as a means of melting steel scrap in lieu of the more facility-expensive blast furnace/coke plant alternative also increases electricity consumption. Moreover, this modernization of our facilities is likely to consume the majority of our profits, with other projects, including conservation, vying for the remaining available capital. Projects with paybacks greater than one year, therefore, will probably not get accomplished if the sole benefit is conservation without any other considerations, such as enhanced quality or production.

## Acid Rain Legislative Proposals

Acid rain legislation, as embodied in Title I of the Committee Print of the House Health and Environment Subcommittee approach (the Waxman/Sirkorski bill), attempts to reduce $SO_2$ emissions through a rigid requirement that utility and industrial $SO_2$ emissions must not exceed 1.2 lbs/MMBtu by 1997. Another approach, in the bill introduced by Congressman Cooper (H.R. 4331), establishes a national tonnage reduction goal for the year 2003 and requires EPA to allocate reductions by formulas to states expressed as emission rate limits. The states are allowed to achieve their reductions through a variety of measures. A third approach, the Senate bill, S. 1894, requires a national tonnage reduction goal for the year 2000 and establishes that each state should achieve an $SO_2$ emission rate of not more than 0.9 lbs/MMBtu by 1998.

The steel industry opposes all of these bills because of the high costs involved and the uncertain scientific evidence regarding the causes, the seriousness and the effect of corrective action on acid rain. The acid rain bills which have been the focus of legislative action thus far (Title II of S. 1894 and Title I of the Waxman/Sikorsky bill) impact the steel industry in three significant ways: 1) electric rates will increase; 2) industrial boilers will be covered by the bills emission reduction plans; and 3) the Waxman bill extends this coverage to industrial process emissions.

First, the increase in electricity rates charged by utilities will severely impact an industry as electric intensive as steel. The electric utility industry is predicted to experience cost increases from $5-7 billion per annum by 2000 due to these bills, which costs will be passed along to industry in the form of higher rates. Thus, any rigid emission rate limit or tonnage reduction will be extremely costly to industry. For the steel industry alone, which spends in excess of an estimated $1.5 billion yearly on electricity, the increased energy costs imposed by these bills could be devastating. The sulfur dioxide ($SO_2$) control requirements could impose on our industry additional capital costs of about 300 million dollars and additional operating costs, primarily increased costs for electricity, of another 300 million dollars per year. Combined with the $NO_x$ provisions this would result in increased steel industry costs of about 700 million dollars per year! This cost analyses applies to the Senate bill, but it is indicative of the level of the "price tag" on these acid rain proposals and of the effect on the steel industry which will be a substantial increase in production costs and a threat to the U.S. steel industry's competitive position in the world steel market.

Second, the bills' provisions extend emission control provisions directly to industrial boilers. Costs of those sections to industry as a whole are estimated to be up to $600 million per annum by the year 2000 under the Senate bill and approximately $1 billion per year under the Waxman bill. These direct costs to industry are disproportionately high since $SO_2$ emissions from industrial boilers account for less than 10% of total $SO_2$ emissions in the U.S. and are decreasing each year.

Third, the Waxman bill extends the states' emission reduction plans coverage to industrial process emissions. This will significantly increase the direct costs to industry as a whole above the $1 billion figures mentioned above. The bills' direct costs to industry do not include additional expenditures incurred to comply with the complexity of this regulatory program and with its accompanying monitoring requirements.

The total effect of these provisions on electric-intensive industries such as steel will be felt primarily in the Midwest where the majority of our facilities are located. The effects will include the potential for shifting production to other locations and employee layoffs.

Finally, it should be pointed out that a better approach for the dealing with $SO_2$ emissions from electric utilities can be achieved by greater use of industrial cogeneration, electric power generated by IPP's and importation of hydropower from neighboring Canada. However, these alternatives can be tapped only if access to the electric power transmission grid -- wheeling -- is made possible. Industrial interests, including AISI, are urging the FERC to provide transmission access to cogeneration facilities and independent power producers in FERC's current rulemaking dockets on competitive bidding for bulk power markets. The problem caused by current constraints on "wheeling" is noted in Chapter two of the Environmental and Energy Study Institute's report, Strategies for Reducing the Cost of Acid Rain Controls.

In conclusion, acid rain bills impose significant cost increases on energy intensive industries such as the steel industry and such costs cannot be readily reduced through conservation. In addition, should the steel industry be forced to subsidize the conservation of others through price increases in electric power, it will be factored into our facility modernization plans. As to the steel industry's Midwest facilities, they will either compete in the world market or their operations will be reduced. Thank you.

Mr. Sharp. Thank you very much, Mr. Prendergast. Let's first go back to the central proposition and help me understand, and perhaps others that are interested in the issue, the central argument over the emissions cap versus the rate of reduction and how that structures incentives and disincentives to different results.

Obviously, Mr. Trisko says it's unnecessary and urges us not to go to the emission cap.

Maybe Mr. Sant, Mr. Geller, or Mr. Moskovitz would like to respond, since Mr. Trisko gave the argument against a cap, show us why it is you believe that we'll get perverse results, in the sense of not the least costly or best emissions reduction, by resorting to the kind of thing that's in the Waxman bill, the rate emissions approach. And walk through that just a little bit more as to where we get perverse results.

Mr. Moskovitz. Let me take just a quick response. As I understand Mr. Trisko's statement, it wasn't that moving to a tonnage wouldn't, in fact, give at least partial if not full credit to energy conservation.

It was rather that energy conservation doesn't need any additional help. That energy conservation is already happening out there and pointed to an EPRI study about hundreds of programs that are in place.

My response there is that energy conservation is, in fact, not happening at anywhere near a cost effective rate. When viewed in the context of cost effectiveness within a utility kind of framework.

As Mr. Prendergast just said, in the industrial area, conservation is pursued in the steel industry, I guess, if it has a payback period of a year or less.

If that same economic test were applied to the construction of utility plants, no utility plant would ever be constructed. They never have a payback period in a year or less.

Instead what we're looking for is to apply a similar type of a payback period, a similar type of a cost effectiveness test, when a utility pursues an energy conservation strategy, than it would in a power plant construction strategy.

In that kind of context, when you view it that way, there, in fact, and I suspect even the steel industry would agree, I know the paper industry now agrees, that on that basis there's a far more cost effective energy conservation that could be tapped than is now being tapped or is likely to be tapped given the system as it's currently structured.

Moving an acid rain policy toward——

Mr. Sharp. Spell that out just a little bit more. In other words how we can, you know, apply that to a utility and tell me where we're going to make a big savings.

Mr. Moskovitz. Well, quite simply, it will have to be at the level of utility sponsored, utility financed, utility purchased, utility investments in energy conservation.

It won't happen at the consumer level, whether it's the industrial customer, the residential customer, or the commercial customer, beyond something that's in that one, maybe 2 year payback period.

If you want to encourage energy conservation or achieve energy conservation that has a payback period similar to utility types of costs, if you want to invest in energy conservation that's, in fact, cheaper than energy production, which is generally what we want to do when we pursue a least cost energy kind of strategy, the only way it can be done is really with utility investment in those kinds of opportunities because consumers simply, as experience has shown, just have a much higher threshold, a much higher discount rate than is implicit in the——

Mr. SHARP. In other words, for the paybacks 5 years, or 10 years——

Mr. MOSKOVITZ. A consumer would—it's highly unlikely that any consumer, certainly an industrial customer, our experience with our major industrial customers is they would never invest in those kinds of projects.

Let me give you a specific example. As you know, Maine now has an integrated conservation bidding program that's in place in our least cost planning process.

We heard from our paper companies, about a quarter of the State's electrical load is due to a variety of paper companies, paper companies will say the same thing that we've heard from the steel industry.

That is we already engage in energy conservation. We've done everything that can be done. We already are a very efficient operation.

And when you go beneath that, the answer you get is to, well, what have you done and how cost effective was it, comes out to about that same 1 year payback period.

It's not surprising. When we opened up conservation to a competitive bid type of scenario where utilities would buy conservation if the conservation were, in fact, cheaper than energy supply.

What we found was the same paper companies that were previously saying we've done everything we can do, they instantly came forward with some very cost effective projects that saved enormous amounts of capacity and energy at approximately 50 percent of the cost of new power supply.

They were cost effective the way the paper industry views their own capital investment decisions, but when the structure of regulation was changed to permit the utility to buy energy conservation at the paper industry's premise, if it was cheaper than energy supply, in this case 50 percent discount, pretty hefty discount, it can happen and those types of opportunities are there in every sector.

The bids that we received, as one of the attachments in my testimony lay out, where in all three customer classes, residential, commercial and industrial, and I believe on average the prices were about 30 to 35 percent discount compared to power supply types of alternatives.

That's what I was referring to when I say if you structure a system, a system of regulation, in a particular way, it may be targeted at one particular element.

I don't even know when it was, back in 1910 or 1920, when people created the system of economic regulation we use for electric utilities, and that's different by the way than the system we use for other utilities, certainly other than—it's not the same system we use, for example, for trucks.

When we structured the particular system, we had something in mind. And it was, at that point, looking at a system of regulation that would keep prices of electricity as low as possible and it didn't look at a system that was targeted at keeping the total customer bills or total energy service costs as low as possible.

By targeting that system of regulation at a particular direction, it ended up producing a system of regulation that was perverse in that zero costs, energy conservation that an electric utility invests in today, hurts their earnings, hurts their profitability, hurts everything that's near and dear to their hearts.

That's the example I use. If you carry that over now to acid rain or any kind of environmental regulation, my point to you is the same.

That is, sure, what you want to do is develop a national policy that solves our acid rain problem. What we would say to State regulators is, while doing that, if you have a series of alternatives available before you, please keep in mind that the particular system you select may have unintended results.

And in this particular case, if, for example, it's cheaper from consumers' perspective, if it's cheaper to reduce acid rain emissions by investing a dollar in energy conservation than it is by investing $1.50 in a scrubber, it makes sense to us to permit that energy conservation alternative to be the preferred choice.

Mr. SHARP. And is there—what inherently in the rate system——

Mr. MOSKOVITZ. Emission rate?

Mr. SHARP. Emission rate system, what inherently prevents a State from going forward with or requiring a conservation approach? Mr. Geller?

Mr. GELLER. Yes. Let me get back to that and try an analogy because I think often it's a little bit hard to grasp this whole problem with the rate limit approach.

Let's just think about a room full of people, this room for example. Each individual in the room could be analogous to a power plant.

The people in the room have an average height. Each person has a height, and all the people together in the room have an average height.

Well, if you remove a person or a number of people with below average heights from this room, the average height for the remaining group of people goes up, even though you've taken away people from the room.

And the same thing happens with the rate limit approach. When you base your goal for States or for a utility for that matter on the average emissions rate limit of all the utility plants, which is a factor of the individual rate limits of particular plants, as well as the amount of usage of individual plants.

As you cut back on the use or even remove from your system cleaner than average power plants, you're going to drive up your state-wide average emissions rate.

Even though you're cutting back on emissions. And that's the fundamental with the rate limit approach and I don't think it's addressed by issues related to interstate transmission or what have you. It's just a fundamental problem with the rate limit approach.

Mr. Sharp. Mr. Trisko, do you disagree with that?

Mr. Trisko. Yes, Mr. Chairman. We disagree with the proposition because it ignores the distribution of power generation capacity in relation to the $SO_2$ emission that we're trying to reduce in acid rain legislation.

The $SO_2$ emissions are produced predominantly by base-loaded power plants instructed prior to the enactment of the 1970 Clean Air Act.

Those are the plants that will be subject to acid rain legislation. Most of those plants are not effected by energy conservation because they are base-loaded plants.

Energy conservation applies, most particularly to peak load units which, because they are very clean and expensive to operate and are operated by definition a short period of the time, contribute negligibly to the utility's total $SO_2$ emissions.

Therefore, we don't see an unintended or counterproductive result with regard to conservation effects through acid rain control.

If anything, the price elasticity effects which would be triggered by the increase in electric rates generally in the economy as a result of acid rain legislation will provide a very positive, strong inducement to additional energy conservation.

Mr. Sharp. So in other words, you're saying that if and when the Congress decides to reduce sulfur, that conservation really just shaves the peak and it doesn't get at the baseload.

Is that what you're——

Mr. Trisko. Yes, Mr. Chairman. In principle.

Mr. Sant. I don't think there's anything to support that. Energy conservation occurs both in base load and peak and it occurs all over the map.

I couldn't begin to say that it only occurs at the peak and, therefore, you'd only be saving there. It seems to me that is a fallacious argument, but more importantly, what you're really trying to do is give all the tools available to people to reduce the $SO_2$ emissions.

By putting a rate limitation only, you're allowing people to only use that one tool. By using a State cap or something in total emissions, you're allowing energy conservation or anything else that will possibly reduce that cap including other sources of electricity, if they are competitive, so that it seems to me that you'd want to have some means of allowing people to address in the most creative way that they can address it rather than limiting it only to a scrubber or control technology.

Mr. Sharp. Mr. Geller.

Mr. Geller. Let me follow up with a couple of examples of where conservation is being very practically used to avoid the need for a coal-fired base load power plant.

One example is in Wisconsin where a utility is attempting to very aggressively pursue conservation, the Wisconsin Electric Power Company at the direction of their State utility commission, in order to avoid retrofitting and prolonging the life of existing fairly dirty coal-fired power plants.

Another example is in Texas where the Austin, Texas Municipal Utility is aggressively pursuing electricity conservation to avoid constructing a 500 megawatt coal-fired base load power plant.

They put conservation side-by-side on paper with the new power plant and found that a wide range of efficiency measures are much less costly, will lead to lower rate increases if they are pursued instead of pursuing the base load power plant.

And I believe in Maine as well, utilities are pursuing conservation and achieving conservation and avoiding the operation of base load power plants as a result.

Mr. Sharp. Let me let both Mr. Trisko and Mr. Moskovitz just respond briefly, and then I'm going to let some of my colleagues ask questions.

Mr. Trisko, if you want to, and then Mr. Moskovitz.

Mr. Trisko. Mr. Chairman, I believe Mr. Geller has succeeded in reinforcing my point, perhaps unintentionally. The examples which he has cited refer to the construction of new plants under the Clean Air Act, which are subject to new source performance standards.

Of course, successful energy conservation programs around the country can result in the discouragement of the investments in new well controlled NSPS units.

One need only read the Washington Post to see that that's happening quite effectively in this region. Both PEPCO and VEPCO have come to the State Public Utility Commissions with proposals for new plants, and they've been hit square between the eyes with the argument, well, look, have you guys investigated energy conservation as an alternative to the construction of those plants.

Acid rain control legislation is really not directed toward the emissions from NSPS new clean well controlled sources. It's directed at the $SO_2$ emissions from the existing pre-NSPS plants, existing base load units, not new ones.

Mr. Geller. I think there's been a misunderstanding. Let me just say that the case in Wisconsin is an example where conservation is being pursued to permit the retirement of an existing power plant, rather than cleaning it up and extending its life and that's for both economic reasons and also because Wisconsin does have a State acid rain control requirement.

They've decided the absence of Federal action to go forward on their own, as a number of States, and the aggressive pursuit of conservation is both helping them to reduce costs, reduce the use of existing power plants, and bring down their $SO_2$ emissions.

It's not the only approach being pursued in the State, but it's one that they are pursuing to impart, help them cut back $SO_2$ emissions.

Mr. Moskovitz. Mr. Chairman.

Mr. Sharp. If you could briefly respond because I want to let my colleagues——

Mr. Moskovitz. It will be very brief because I believe there's really no need to resort to these kind of really anecdotal experiences.

It's a relatively straight-forward, factual question that will differ from area to area. It's a relatively simple thing to ask, in effect, a computer program for a typical utility in the Midwest or the ECAR region to say how much $SO_2$ will be reduced if you reduce demand by 2 percent.

And the mechanisms are readily available for every utility, for every region, to ascertain precisely how much sulfur dioxide would be reduced, how much emissions would be eliminated, if energy conservation with any particular, any particular characteristics are implemented.

I'm confident that in the mid-west that relies so heavily on coal-fired power, both for base and intermediate kinds of capacity, that energy conservation would, in fact, back out coal-fired production.

Right now, I suspect even here in Washington D.C., if you were to turn off these lights right now, probably what would be backed off the system would be some coal.

But we don't have to argue about it in a forum like this. It's a relatively straight-forward and factual determination that really is unlikely to be subject to much dispute.

Mr. SHARP. I recognize our colleague from California, Mr. Moorhead.

Mr. MOORHEAD. Thank you, Mr. Chairman. It seems to me that if we would pass the Nuclear License Act or have it amended to this bill, the cleanest of all energy, that we could do an awful lot towards reaching the goals that we're seeking.

Mr. SHARP. As long as somebody wanted to go out and invest in a plant. That's the second requirement of that.

Mr. SANT. If you can find any money for that, let me know.

Mr. MOORHEAD. Well, you know, in California we need to do something about converting salt water to drinking water and it's a big, big problem and they do have a plant that they are considering that would do that very thing and use all the modern designs, but it will accomplish that as well as produce electric power.

So maybe that's something that isn't as far away as you think. If it becomes necessary, we'll do it.

Mr. Prendergast, on page 2 of your testimony, you state that steel companies have ongoing conservation programs and goals.

Would you identify some of the more significant conservation goals that you have?

Mr. PRENDERGAST. I don't know if you know the history of LTV Steel, but its a conglomeration of Youngstown Sheet & Tube, Jones & Loughlin, and Republic, and there was a merger in 1984 between Jones & Loughlin and Republic which formed LTV. In 1986, we sought Chapter XI protection under the Bankruptcy Code. So we're a mixture of the policies and programs of various companies.

In our particular company, right away, since the merger of 1984, we set new goals, and those goals were rather stringent, 3 percent per year, and we have met and exceeded those goals. We have set lesser goals for 1988 and 1989, down to 2 percent per ton of shipped steel, and just by virtue of the fact that a lot of the work has been done. We've taken a lot of the older inefficient plants out of the system, and that's where you start. You take the gas-guzzlers and those types of—those energy-inefficient operations out, because they're more costly operations.

Mr. MOORHEAD. Is there any movement in this direction?

Mr. PRENDERGAST. We have closed and we continue to close plants and take them apart and level the ground. Yes, and we're still looking at continuous casting, which has saved us two to three million Btu's per ton. We're looking at going further on the continuous casting route. Hopefully someday we'll get to 100 percent continuous casting.

Mr. MOORHEAD. How about your competitors? Are they doing basically the same thing?

Mr. PRENDERGAST. All of the competitors that I am aware of are following the same approach. We have some advantages being in Chapter XI. I mean, we're generating cash at the present time. By virtue of that, we can take this money that's being generated and reinvest it back into our facilities. Our competitors don't necessarily have that advantage at the present time. They have creditors out there with pre-existing obligations that they have to meet.

Mr. MOORHEAD. You state that reducing energy use at this point are likely to be extremely costly. What are these measures that would be so costly, and why are they so costly?

Mr. PRENDERGAST. Well, it was mentioned in one of the reports that one of the large areas for energy conservation was electric motors. When I think of electric motors, and I've had experience in their operation, a large steel plant has thousands of motors of varying sizes. To begin to really exert the engineering expertise and talent that we have available, which is limited to looking at all those motors and looking at replacing those motors, would be extremely costly, as compared to one new facility, an electro-galvanizing line, which is a 40 megawatt facility. So we concentrate our efforts on those that are more cost-effective. We look at the larger items. We're not looking day-to-day at electric motors, although we're conscious of the fact that energy-efficient motors do exist.

Mr. MOORHEAD. You know, you make one statement in your statement that I wonder what caused you to make the comment: If we're required to subsidize other ratepayers to conserve energy, we'll be disadvantaged further.

Obviously that's a true statement, but what made you feel that that was a part of this record?

Mr. PRENDERGAST. When I read these reports, I got the underlying feeling that somebody is going to have to pay for this conservation, and having experience with electric utilities, I know that they do not want to expend any of their funds, which means that they will be looking to the other ratepayers to subsidize this effort.

Right now in the majority of areas that the steel companies work in, we're subsidizing the other ratepayers, the non-industrial ratepayers. There's a definite subsidy there, and we're very fearful that certainly any additional subsidies to the residential/commercial class could disadvantage us further in the world markets.

Mr. MOORHEAD. Mr. Sant, on page 2 of your testimony, you state that conservation will allow utilities to operate their cleaner plants without incurring large additional operating costs. Won't a utility's choice be driven in part by the plant's operating cost, especially if the operation costs are high due to the cost of emission controls?

Mr. SANT. Sure. If I understand your question correctly, I think that's true. But nevertheless, the flexibility that comes says you're only going to retrofit so many plants, and then you'll be able to dispatch those plants and the service based on the emissions of those plants. And it seems to us that the degree—that conservation provides a degree of greater flexibility in doing that. The more you can reduce demand, the more you have flexibility in how to use the existing plants, so that it's likely that in an environmental dispatch mode, which is probably an economic dispatch mode, which means that you'll be—the dispatcher will be using the plants that have the lowest emissions as well as the lowest costs, conservation probably provides a good deal more flexibility, at least in the transition years.

Most utilities have a fairly high reserve margin right now, and this probably provides a greater degree of flexibility. So I think the focus that we, at least, have is on trying to reduce costs of acid rain controls, not, you know, to get it at any cost, and it seems like conservation probably provides greater flexibility in doing that.

Mr. Moorhead. But if we go with this trend, won't it cause the utility to avoid the cleaner, more expensive plants, given a choice?

Mr. Sant. I don't see why that would be the result.

Mr. Moorhead. Because they're trying to avoid expense.

Mr. Sant. Well, they'll try to—I mean, everybody is trying to avoid expense, and everybody that's trying to do this is controlling the lowest cost possible. All we're suggesting is that conservation may be cheaper at some parts of this curve than would be controls, and you ought to use conservation when it is cheaper.

I don't think anyone should argue that conservation should be used when it costs more than other kinds of controls, and therefore I don't see how you would get into the kind of trap you're talking about.

Mr. Moorhead. But do you agree with Mr. Trisko's assertion that the emission rate approach is more consistent with the Clean Air Act's general approach to air quality regulation than the tonnage alternative?

Mr. Sant. Sure. It certainly is, as the Clean Air Act now stands, emission rates with the way you apply for a permit, and it's the way we've used to enforce the Clean Air Act. That doesn't mean to say that couldn't be changed, and it's always been—I'm an independent power producer; our company is an independent power producer. It's always seemed to us that it would have been better if we could approach it on a total emissions standpoint rather than a best available control technology or percentage control or pounds per million Btu.

It just seems to achieve these national goals. We ought to allow all of us to use the most creativity we can bring to the table, and anything that reduces those options seems to me to kind of miss the point.

So I think it's a fundamental flaw of the existing Clean Air Act regulation as much as it is a proposal for $SO_2$.

Mr. Moorhead. Well, one thing I wanted to ask, we all know there's a limitation out there on the total amount of natural gas that's available. At the same time in recent years, there's been a relative abundance of it available, at least in many parts of the country.

For any of the members of the panel, what role should increased use of natural gas play in the clean air quality strategy that we have?

Mr. Sant. You say it correctly. It's always—we always thought it was in short supply. I remember when I used to come up here and testify on behalf of the administration, we always told you there wasn't going to be any more natural gas, and here we are having an abundant supply. So perhaps part of our problem is, none of us are that able to foresee the future.

Mr. MOORHEAD. Well, of course, in Prudhoe Bay, we're pumping the gas back into the ground. I don't know how much of it is saved and how much of it isn't, but——

Mr. SANT. Wouldn't it be great if we had some way to burn it up there. Transporting it is what's costly.

I think it really says that we ought to use natural gas when that's cheaper. It's not necessarily true that natural gas is going to be a major contributor to that, but if it were available to someone to switch from coal to natural gas, which is not likely, but if it were, it ought to be used.

And any way that a utility or an industry or a State can find a way of reducing these $SO_2$ emissions, they ought to do it. It's—I don't know how long the gas bubble will last, but as long as it's here, we ought to use it for what it's worth, and if it starts to run out, and the costs go up, then we'll clearly start switching to other options.

Mr. MOORHEAD. Some of these alternative fuels are cleaner. George Bush opened up the first methanol station out in Los Angeles this last week, and there will be many that follow.

Of course, our committee, with the leadership of our chairman, Mr. Sharp, has been working in this area, and California has been moving forward on it, and that is the cleaner air—gives us cleaner air than gasoline does certainly.

Mr. SANT. There are some problems with $CO_2$, I would like to point out, that we ought to take account of, if we worry about the greenhouse effect.

Mr. MOORHEAD. Yes.

Mr. TRISKO. Mr. Moorhead, just a follow-up response on that comment with respect to natural gas. As Mr. Sant points out, there are no facts about the future. It's very difficult to predict the future course of natural gas prices.

One of the difficulties with the tonnage cap approach is that it potentially has rigidities which would limit utilities in their future generation options, if natural gas prices do rise significantly. In the case of the Mitchell bill in the Senate, which is a true cap bill, it's estimated that the cost of compliance with that emission cap in Oklahoma, Texas, Arkansas, and Louisiana, areas which are heavily dependent on oil and gas, could reach $2 billion annually when the program became fully effective.

Mr. MOORHEAD. One thing, Mr. Trisko, that you state in your submitted statement is that 33 States have some form of least-cost utility planning regimes already in place. What role does the Federal conservation legislation play in that, or is it really necessary if the larger States already have programs in place?

Mr. TRISKO. I think, Mr. Moorhead, there is a case for federalism to be made in the case of energy conservation by virtue of the fact that we've got 33 States which are serving as laboratories for the development of these least-cost planning programs.

The Federal conservation incentives, which you refer to in the form of conservation-related information or appliance efficiency standards and the like, are part and parcel of State regulatory programs, and they're complementary to them.

Mr. MOORHEAD. OK. Thank you very much.

Mr. SHARP. The gentleman from Florida, Mr. Bilirakis.

Mr. BILIRAKIS. Thank you, Mr. Chairman.

I have a couple of what I consider foundational questions to ask regarding conservation/acid rain. But before I get into that, I would like to read from Mr. Geller's prepared statement starting at the bottom of page 3 and ask the rest of you if you agree, yes or no, regarding that statement. Mr. Geller said:

> Because of this opportunity for cutting acid rain emissions without economic hardship, we believe it's critical that acid rain legislation provide States and utilities with full credit for emissions reduction achieved through electricity conservation. In addition, Federal legislation should encourage States and utilities to pursue conservation in conjunction with pollution clean-up. Not all legislative proposals for acid rain control do this. In particular, statewide average emissions rate limits—that is, limits on pounds of sulfur dioxide emitted per million Btu of fuel burned—do not provide full credit for conservation induced emissions reductions and could even discourage conservation.

Mr. Sant, do you agree that the Waxman acid rain legislation should contain a provision to provide proper credits to States and utilities for conservation?

Mr. SANT. Yes.

Mr. BILIRAKIS. Mr. Trisko?

Mr. TRISKO. I don't believe it's feasible to do so, sir.

Mr. BILIRAKIS. You don't believe it's feasible to do so?

Mr. TRISKO. No, sir, because of the simple fact that power is not necessarily consumed in the State in which it's produced.

Mr. BILIRAKIS. Mr. Moskovitz?

Mr. MOSKOVITZ. I do agree with the statement.

Mr. BILIRAKIS. You do. Mr. Prendergast?

Mr. PRENDERGAST. To the extent that it adds more flexibility to the program—I'm an old operator, and I like flexibility—certainly, yes. But the fact remains that we've done our work, and we don't want to pay for it.

Mr. BILIRAKIS. Well, if you were a utility and if you were already doing your work in terms of conservation, would you want to receive a credit insofar as the emissions are concerned?

Mr. PRENDERGAST. Well, I think, as I said before, it gives them more flexibility, and as such, yes.

Mr. BILIRAKIS. Mr. Geller, obviously you agree.

I would ask you to provide me specifically with proposed language, to the Waxman acid rain bill that would be consistent with your recommendation. You can certainly use Mr. Sant or any of these other people to assist you in that regard. And the sooner the better.

Mr. SHARP. We will certainly make that a part of our record and available to everybody.

Mr. BILIRAKIS. Thanks, Mr. Chairman.

Now I would ask, Mr. Geller, again, you gave us the example of a particular power company that was faced with needing additional power, and they were faced with the alternative of building a new plant or finding conservation measures, and they opted for conservation measures; and as a result they were able to produce the energy that was needed without having to go to the expense of the new plant?

Mr. GELLER. Either to avoid a new plant or to cut back on the use on existing plants possibly.

Mr. BILIRAKIS. Yes, all right.

Mr. GELLER. Particularly dirty plants.

Mr. BILIRAKIS. But what that tells me is that the capacity, the potential to have had conservation was there all along, but when they were faced with this additional tremendous cost of a new plant, they kind of woke up and said, hey, let's look at other alternatives; is that correct?

Mr. GELLER. Yes.

Mr. BILIRAKIS. All right. That being the case with regards to that particular example, then would we say, there is a large amount of capacity for additional energy conservation existing with our power plants throughout the country?

Mr. GELLER. Well, the potential exists today throughout households and buildings and——

Mr. BILIRAKIS. Right.

Mr. GELLER. We've heard from one industry, and it's confirmed by the commissioner from Maine that a lot of this potential isn't being pursued. People in industries tend to only invest in those 1 or 2-year paybacks, a very quick return. So, yes, that potential is out there, and you don't need acid rain legislation to justify conservation.

Mr. BILIRAKIS. All right.

Mr. GELLER. Conservation can become more effective when you also have——

Mr. BILIRAKIS. And Mr. Trisko is shaking his head, and I know that was one part of his statement, too.

Mr. GELLER. Yes, I would agree with that.

Mr. BILIRAKIS. So you agree there. But I would ask is there enough of this capacity in terms of conservation that conceivably might go a long ways toward solving the, quote, acid rain problem without the necessity of additional legislation?

Mr. GELLER. Well, in terms of reaching the emissions targets, the 8 million or 10 million or 12 million ton reduction that these various bills put forward——

Mr. BILIRAKIS. Whatever the proper targets might be.

Mr. GELLER. Right. Conservation can help. It might get you 10 or 20 percent of the way there in actually getting your emissions down. I think that's significant, particularly when you think about the costs go up pretty steeply as you rise above 5 million tons, the next million tons, or if you rise above 10 million tons that some would like to see happen, that incremental marginal million tons would be quite expensive. And if you can use the conservation to avoid those relatively expensive scrubbers or coal switching situations, I think it would benefit a lot economically.

Mr. BILIRAKIS. Thank you. You said 10 to 20 percent. Might there be enough potential for energy conservation if we concentrate on it to reach the 5 million ton figure?

Mr. SANT. I guess I'll add, I'm not quite sure how far that would go. I think the principle we would argue is that what's been called "least cost" ought to be applied for $SO_2$ reduction as much as for any other thing. Therefore, you ought to use conservation as long as it's cheaper than the cost of putting on a scrubber.

Mr. Bilirakis. Right.

Mr. Sant. And what that exact potential is, whether it's 10 percent or 15 percent or 20 percent, probably will be determined in practice, but it ought—we ought to have the flexibility to use conservation. Let's say if a scrubber, trying to get up to 95 percent clean-up, costs you two cents a kilowatt hour, at that point conservation would be very attractive and a real competitor. If you went down to a scrubber cleaning up at 70 percent, it might only cost two mills or something to do that, and therefore it shouldn't be used. So it's kind of a continuum that says, let's use conservation to achieve the lowest cost $SO_2$ reduction and coincidentally get all of the other benefits of conservation.

But I don't think I would argue anyway that we ought to use conservation beyond the point where it's cost-competitive.

Mr. Bilirakis. Right. But the bottom line is to have adequate energy to meet our needs and also to try to clean us up as much as possible.

Mr. Sant. Exactly.

Mr. Bilirakis. Isn't that right?

Mr. Sant. Exactly.

Mr. Bilirakis. And we should then be looking at all potential alternatives to reach those goals.

Mr. Sant. And I think that would be the major point that we'd like to make, is that at least include energy conservation as a possible solution where it is competitive. If a ratepayer in the Midwest is paying five cents a kilowatt hour, and the cost of pollution is going to raise that to seven cents, that additional 2 cents ought to be made available to conservation where it could be done cheaper than that, and there are lots of conservation technologies.

Mr. Bilirakis. So you would satisfy two things conceivably, conservation, and clean-up.

Mr. Sant. The wonderful thing about conservation is—I don't agree with Mr. Trisko that it should have only one compelling reason. There are lots of compelling reasons for conservation. It's only in this case—$SO_2$ shouldn't be the only reason to conserve, but if we're going to provide a subsidy for other kinds of $SO_2$ controls, let's not lose the opportunity to provide that kind of subsidy or that assistance to conservation over and beyond what would happen if that weren't made available.

Mr. Bilirakis. What's wrong with that statement, Mr. Trisko?

Mr. Trisko. I can't take exception as it was presented, but I think it contains a given which ought to be examined on its own terms, and it seems to assume that the alternative approach, the emission rate approach, discourages the use of conservation, and I don't believe that's been proven.

Mr. Bilirakis. Well, all right. But even if it hasn't been proven, doesn't it make sense that if you provide the credit there, the carrot there, that probably the one will follow? It may not follow to the extent that these gentlemen, the other four gentlemen here, think that it will, but doesn't it follow in direct proportion?

Mr. Trisko. There's no doubt that if one enacted a tonnage type of acid rain control program with explicit incentives for energy conservation in the administration of the program, that one could further encourage conservation. The question is whether it's worth the cost of the additional difficulty in administering that program.

Mr. Bilirakis. That's got to be a part of the equation, Mr. Trisko.

Mr. Trisko. Part of the tradeoff.

Mr. Bilirakis. Yes, that's got to be a part of it.

Is there anything further that you gentlemen might wish to offer in that regard? I'm going to limit my questioning to this particular area.

Mr. Moskovitz. The only thing I would add—and it's what I sort of see as the difference between what Mr. Trisko was saying and Mr. Sant—is if you have an emission rate designed program, that the incremental cost of the clean-up is not available as an energy conservation incentive, if you will. It will not be built in.

If a utility has to meet, let's say, 1.2 pounds of $SO_2$ per million Btu, and they have to meet that regardless of how much that plant operates—they just have to meet that number—then they have no possible alternative way that conservation could help satisfy that requirement.

Mr. Bilirakis. Right.

Mr. Moskovitz. So that at least with respect to the incremental cost of the clean-up—now I think Mr. Trisko is wrong, that if you go an emission rate route, you will not make that incremental portion available for conservation, and if you go other routes, of which tonnage is one, that incremental cost would be available and therefore would become an option available to States to satisfy their obligations.

Mr. Bilirakis. Sure. If you're required to meet that certain emission standard and have to undergo the costs to meet it——

Mr. Moskovitz. It's a set cost.

Mr. Bilirakis. Right. It's a set cost. So why go to additional cost to conserve?

Mr. Moskovitz. I think Mr. Trisko's point is, if it costs you three cents to produce power now, there's already a three-cent incentive to engage in energy conservation. That I agree with. That's true. That incentive is there.

What his perspective misses, though, is if it does cost an additional one cent on top of the three cents to clean up the production——

Mr. Bilirakis. Thank you, Mr. Chairman.

Mr. Sharp. Let me let Mr. Oxley ask some questions, and then we're going to have to take a break for the vote, and we'll come back and have further questions.

Mr. Oxley?

Mr. Oxley. Thank you, Mr. Chairman. I appreciate your indulgence.

I would first ask that my opening statement be made a part of the record.

Mr. Sharp. Without objection.

[The opening statement of Mr. Oxley follows:]

## OPENING STATEMENT OF HON. MICHAEL G. OXLEY

Mr. Chairman, I want to thank you for calling this hearing today so that the subcommittee can continue to examine the various impacts that acid rain control legislation could have on national energy policies and programs.

This morning, the Health and Environment subcommittee is scheduled to continue its markup of Clean Air Act amendments, including H.R. 2666, Congressman Sikorski's acid rain bill. While the subcommittee has technically completed action on that portion of the bill, their actions today should serve as a reminder to this subcommittee that we have our own responsibilities toward the pending legislation. Should Health and Environment complete action on the entire bill, our own subcommittee will have an important opportunity to review it and hopefully ensure that an effort to protect the environment does not, at the same time, negate any number of energy gains and policies.

Energy conservation is an example of an energy policy that could be impacted by acid rain control measures. However, there is a significant amount of disagreement as to exactly what the impacts might be, and we are here to learn more about those impacts. For example, a study released just last week by the Ohio Office of the Consumers' Counsel maintains that energy conservation measures, when employed as an integral part of acid rain control policy, could cut the costs of $SO_2$ emission controls by as much as 60 percent, without negatively impacting Ohio coal use. Others, however, insist that energy conservation measures used as part of an acid rain control strategy do not account for true emissions reductions and therefore should not be counted in total tonnage reductions of $SO_2$. Furthermore, evidence exists that different approaches to acid rain control, such as emission rate caps versus tonnage reduction caps, can create actual disincentives for utilities to employ conservation measures. While I believe that adopting acid rain control legislation at this time is premature and potentially very damaging to my State, all of these issues need to be examined closely so that we can get a better idea of exactly how energy conservation might fit into the acid rain control picture, if indeed we are forced to take that path.

Thank you, Mr. Chairman.

Mr. OXLEY. Thank you.

Mr. Chairman and members of the panel, if utilities earn a rate of return on plant investment currently, why not allow some kind of rate of return on investment in conservation, as an incentive? I see Mr. Moskovitz leaping to the mike.

Mr. MOSKOVITZ. I've been going around the country giving this speech.

Mr. OXLEY. Well, this is a chance for you to have a platform.

Mr. MOSKOVITZ. Well, I appreciate it.

One of the attachments to my testimony is a copy of the talk I gave in Aspen, and I was specifically there looking at the various incentive schemes that have been talked about to encourage utilities to invest in conservation, and one of the principal ones that always comes up is, if you can earn a return on investing in powerplants, why not simply allow utilities to earn a return on investments they make in energy conservation?

And on its surface, that's entirely plausible and a desirable type of a response. If you go beneath that, though, and look at how we actually set rates, how utility commissions like the Maine Commission and every other commission around the country, including the Federal Energy Regulatory Commission, how they actually set rates and how the ratemaking process actually corresponds with utility earnings, Table V in that example shows, in the typical utility situation that I presented there, that a 2 percent efficiency improvement if a utility were to embark on energy conservation, that would save customers 2 percent of the energy that they now save, would reduce the utility's earnings, at the utility hypothetically that I used, by $6 million, roughly $6 million.

Even if that conservation that they bought was very expensive—that is, they got to invest as much money as they possibly could to achieve that 2 percent improvement—the earnings that they would receive on that investment would be—I think it was $280,000 or something of that order of magnitude, so that rate-basing of conservation investments makes up for less than 10 percent of the negative impact on earnings that the conservation in the first instance has.

So while it's a sort of desirable goal, rate-basing conservation isn't the answer, which is why most utilities don't bother with seeking a return on investments in conservation, because it's basically not worth the bookkeeping. They'd rather just expense it and not earn a return.

We permit rate-basing of conservation in Maine, and no utility has ever asked for it. It simply isn't worth the bother. There's no money there.

Mr. OXLEY. How do we build in an incentive if we can't do it through the rate base?

Or maybe we want to take a totally different approach to rate regulation. We're looking at that, for example, in the telephone industry now.

Mr. MOSKOVITZ. That's a good example.

Mr. OXLEY. Perhaps there's some other way we can approach that.

Mr. MOSKOVITZ. That's a very good example. There are lots of different systems of economic regulation that are, in effect, available to regulate any entity, and we're looking at all sorts of fairly novel approaches in the telephone area, and I believe that we have to start looking at new approaches on electric also.

In that same paper, I've presented a particular alternative that answers the problem that we're pursuing in Maine. There are other approaches in my example again, that Table V example, that will more than restore the $6 million to the utility, so that conservation is an attractive option.

The framework that we've set forth, the challenge, in effect, that we put to our utilities and that we're putting to other regulators around the country, is we want to see 2-cent conservation more profitable to a utility than 3-cent supply. Three-cent conservation should be as profitable as 3-cent supply and on and on. And I have no doubts that there are at least a dozen systems of regulation that could be adapted to meet that underlying principle. We've come up with one in Maine that we're pretty excited about and hope to have it implemented in a reasonable time period. There are others, and I would encourage everyone to look at them.

Mr. SANT. Could I just add one thing?

Mr. OXLEY. Yes.

Mr. SANT. One of the other fundamental problems is that we typically think that if a kilowatt hour costs 5 cents, that we ought to be willing to pay—our utility ought to be willing to pay 5 cents for someone to conserve that. But the problem is—and it kind of gets into what's been called a no loser's test, that if a ratepayer saves a kilowatt hour and thus saves 5 cents, he already gets that 5 cents back. If the utility then pays another 5 cents for avoiding that, he's really double-paid, and the rest of the ratepayers would have to make up that difference. And it's kind of a fundamental fairness question that has really gotten in the way of something that sounds fairly simple, but gets a little more complicated.

So it ends up that in a true fairness test, you could only pay the difference between what the ratepayer is now paying and what the costs of new capacity would be. So if it's now paying five, and new capacity is seven, then a utility can clearly afford to pay 2 cents for someone to conserve, plus the 5 cents that the ratepayer would already receive for conserving.

Mr. OXLEY. If I could just perhaps take out some midwestern frustrations on our friend from Maine, especially since our former colleague is now Governor up there. From the Midwest perspective it appears there is a kind of blind spot in the Northeast for certain forms of energy—for nuclear, deregulation of natural gas, some aspects of deregulation of hydro, the question of ANWR and offshore drilling. It goes on and on.

I guess our frustration in the Midwest is that the acid rain problem has been taken out of the overall context of policymaking and set above the rest. As a result, we've ignored all of these other efforts that would indeed be less polluting, would not cause acid rain. We've tended to really zero in on only the powerplants in Ohio, Indiana, and other midwestern States.

Is that a fair assessment of the position that we find ourselves in, the Northeast vis-a-vis the Midwest, or is that perhaps a very parochial position that some of us have taken in the Midwest?

Mr. MOSKOVITZ. Well, I certainly can't speak for the Northeast, and I can at best speak for the Maine Public Utilities Commission.

It's not a position that certainly we've taken. Our approach to this issue, as it is to most any issue, is we'd like to see whatever reasonable regulation that has to be done to protect our environment, and we haven't taken any position as to exactly what that is, who should clean up what plant, but that whatever methods is selected to accomplish it maximize the flexibility of the States and the utilities to meet the environmental goals that the Nation sets.

Mr. SHARP. We have only 4½ minutes to get over and vote, so I think we'll——

Mr. OXLEY. Yes. One more question, if I could. Did the Commission itself take any position on Yankee, or was that——

Mr. MOSKOVITZ. No. We took no position.

Mr. OXLEY. Thank you. Thank you, Mr. Chairman.

Mr. SHARP. We'll take about a 10-minute recess, and then we'll have further questions.

[Brief recess.]

Mr. SHARP. The subcommittee will please come back to order. Thank you.

Mr. Sant, there's been some dispute over the carbon dioxide ($CO_2$) emissions that would result from the production and use of methanol, and you alluded to the fact that anything we burn creates $CO_2$, so that is not an escapable problem. The question is whether methanol creates more $CO_2$ emissions than gasoline or other alternatives, and I wonder if you'd care to comment on that.

Mr. SANT. Yes. I think it needs to be clarified that methanol from natural gas is quite different from methanol from coal, and methanol from coal is a disaster, but methanol from natural gas is probably quite attractive. But I'm not sure that everyone in this $CO_2$ or greenhouse debate would totally agree with that, but it strikes me that methanol from natural gas—in fact, the statements being made these days by the Bush people and others would clarify that they're really talking about methanol from natural gas, I think we would reduce the kind of conflict that seems to be coming up, because natural gas clearly has less $CO_2$ output than gasoline, so that's an advantage. Then the cost of converting natural gas to methanol ought to be small enough to not worry too much about. So I think that's an appropriate clarification, not for this hearing, but——

Mr. SHARP. No. But our problem is it's become a struggle in the debate over the legislation before us. I just like to reinforce a couple things about methanol. First of all, our anticipation is that the economics are such that methanol from coal is somewhere in the distant future.

Mr. SANT. Thank goodness.

Mr. SHARP. Methanol will clearly be made from natural gas, but it might even be made from natural gas elsewhere in the world or various underutilized resources that cannot be easily transported, perhaps even Alaskan North Slope natural gas which is expensive to transport.

The other point I'd like to make about our legislation is that the legislation does not pick the extender or replacer fuel for gasoline. H.R. 3399 tries to overcome some of the barriers to introduction of technologies that use methanol, ethanol, or compressed natural gas. There are many advocates for each of those various options. We are simply trying to overcome the governmental and market barriers to the introduction of technologies that can take advantage of these fuels. We frankly think choice of fuels will be driven by the Clean Air Act in many of the non-attainment areas.

I wanted to reemphasize that there are a number of studies that argue that there would be less $CO_2$ emissions with methanol than gasoline when the methanol is derived from natural gas. There apparently is one study coming out that argues the opposite view, and we're challenging the scientific assumptions that have gone into that particular report.

Well, let me turn back to where we were.

Mr. Bilirakis, do you have an immediate question to follow on, you were kind enough to defer to Mr. Oxley. Otherwise, I'll proceed with some additional questions of my own.

Mr. BILIRAKIS. I haven't. Thank you, Mr. Chairman.

Mr. SHARP. Let me turn back to conservation. If the Congress adopts an acid rain control program, and if it were to adopt what Messrs. Geller, Sant, and Moskovitz, I think, are suggesting, which would be emissions caps, then we structure a new debate over whether we're limiting economic growth.

I would like Mr. Geller and Mr. Sant to address this question, the criticism that emissions caps frontally limit economic choices.

Mr. GELLER. Well, as I said in my remarks, we have the example—I know of at least one State that's had fairly rapid economic growth and population growth, and that's California, and they've done much better than average on cutting electricity use per capita than other States as a whole. It's quite dramatic. I looked at the data from 1980 to 1985. For the country as a whole, electricity use per capita was going up about 1 percent per year. In California, it was dropping 1 percent per year.

So it's clear that rapid economic growth does not necessarily mean rapid growth in electricity demand. California made very conscious efforts to keep down growth in electricity demand through building codes and State efficiency standards and vigorous utility conservation programs. And that, of course, as you hold down growth in electricity demand, you hold down the increase in emissions, so that that increase in emissions doesn't have to be there if you have robust economic growth.

And then I think it's evident that there's a wide range of pollution control technologies available, everything from scrubbers to coal switching. Conservation can help. Newer, cleaner generating technologies, natural gas fire technologies that came up a little bit before, that utilities are now beginning to turn to, gas-fired combined-cycle power plants, for example, which some utilities are beginning to order, including a utility here in Washington, so that there's quite a mix of technologies for controlling $SO_2$ emissions, and no matter how stringent that ceiling is, there should be a combination of these approaches that could be implemented to reach the ceiling without limiting economic growth in any way.

Finally, I believe Mr. Trisko mentioned the problem of areas of the country that might need to increase their coal use to a great extent, if they're building a lot of new plants or switching from existing oil or gas capacity to coal capacity, and I would think that there could be some provision in legislation whereby if a State has increased its amount of coal-fired capacity either from fuel switching or from new construction by a certain amount, let's say it goes up 50 percent, that additional new plants could be excluded from the ceiling. They're already going to be relatively clean because of the NSPS provisions, and a provision could be made at some point for excluding new capacity when new capacity becomes so overwhelming that it becomes incredibly difficult to adhere to your ceiling with all that new coal capacity.

Mr. SHARP. Does somebody else wish to take that on?

Mr. SANT. I think that's the right approach. I think you could easily handle it in a way of just existing facilities are covered by a cap, and then new facilities are covered by an NSPS standard, and even the complexities of that, at least I'm satisfied you could find some way to deal with it.

Mr. SHARP. Well, if I understand, Mr. Moskovitz, that's one of your suggested possible outs on this.

Mr. MOSKOVITZ. Yes, I did include that.

Mr. SHARP. To use a cap on existing plants, but NSPS standards on new plants.

Mr. MOSKOVITZ. I'd have to say when I put that in my testimony, it seemed to me that that approach would still give conservation full credit. To the extent that remains true, then I think it's a viable option. It's certainly consistent with NERUC's position.

I tend, however, in the first instance, to agree with what Mr. Geller said, which is that a limit on $SO_2$ emissions by itself isn't a limit on growth; it's only a limit on $SO_2$ emissions. It isn't even a limit on electricity production.

But nevertheless, I do, as you point out, suggest that one option may be, if you really believe the only way to go is to build new things that emit still more $SO_2$, is to, in effect, separate old from new.

Mr. **Sharp**. Mr. Trisko?

Mr. **Trisko**. Mr. Chairman, the reason I submitted the chart for the record on Allegheny Power System's wholesale transactions to other utilities was to illustrate the point that when oil prices change, there are tremendous economic incentives to displace oil in the utility market in different parts of the country, and a cap type approach, even applied to existing sources, could deny utilities the flexibility that they need in order to run their existing coal-fired plants at a higher capacity utilization in order to displace oil-fired generation in other parts of the country.

So in that sense, a tonnage cap can greatly limit operating flexibility which makes possible the economic displacement of oil-fired generation.

Mr. **Sharp**. So in other words, if our goal is to reduce oil imports, then what you're arguing is that this could work counter to that.

Mr. **Trisko**. It could be contrary to that policy, Mr. Chairman.

Mr. **Sharp**. Our difficulty always is, we have multiple goals that we're trying to achieve.

Mr. Moskovitz, do you believe the data is there for us to understand more clearly the impacts of what a cap would do and what the alternatives to a cap might be?

The reason I ask is that the mix of energy use in an area may inhibit the nature of economic growth. For example, we obviously understand that a McDonald's is different than a steel company in terms of energy use.

Mr. **Moskovitz**. If the question refers back to my statement that if you just want to know how much $SO_2$ is going to be saved if you adopt a conservation strategy, that data, I think, is readily available. Someone will have to run the computer models, but those are relatively straightforward, relatively non-controversial, very available to both utilities and commissions. We can run a simulation that will tell you how much $SO_2$ or how much fuel each power plant will consume under a wide—any scenario you'd like.

Mr. **Sharp**. But can you tell us, can you really get at what will be happening in the marketplace in terms of actual conservation, or aren't you just assuming 10 percent conservation without identifying where that 10 percent conservation can be achieved?

I mean, it's easy to go back and say what would happen in, say, two dozen powerplants. The much more difficult thing is whether we're talking about conservation in 10 industrial plants or in thousands of homes, and whether the end result is decreased use of electricity and, if so, how much less use?

Mr. **Moskovitz**. I think that what you said is true. Energy conservation, of course, is only one relatively small element of the larger uncertainty, which is how well do we do at forecasting how much electricity people will consume. And there, no one has been very good at it, and whether they've been wrong because they've underestimated conservation or overestimated X, Y, or Z, you know, it varies from forecaster to forecaster.

But in terms of developing a strategy, what we would generally do when we pursue these types of issues is, in effect, run sensitivities. We look at a wide range of plausible scenarios and see how sensitive our particular alternative decision is to various changes in assumptions, and in that regard, we certainly can see and measure, I think, with substantial precision how much of a reduction one can get in $SO_2$ emissions, if one pursues an emission rate strategy versus a tonnage strategy.

We could, for example, estimate how much incremental energy conservation, for example, would be made available if the incremental cost of $SO_2$ clean-up were, in effect, made available to have conservation compete against. Those kinds of estimates, within reasonable bounds, can be made. They are made. The same estimates are made when people decide whether or not to build power plants. So if you can rely on them to build power plants, we generally rely on them to look at the alternatives to power plants and try to treat them symmetrically.

Mr. SHARP. Unfortunately we have another vote on the House floor, and I don't know if we can actually get people back together after that, but let me pursue one more question and maybe wrap up before the vote.

Is the presumption of the cap approach that it would be allocated by State, and then therefore it is up to each State to determine whether to empower the utilities to pursue it, whether to adopt various kinds of end-use requirements? In other words, who makes the decisions that may pay off in conservation?

Mr. SANT. I think that's—what we are kind of arguing is the coordinated State effect. Each State may approach that differently, and I—we were just talking at the break that there may be some States who decide we can't do anything but rates, and so we're going to have rates as the way of implementing the cap, and we'll give offsets——

Mr. SHARP. They would adopt the emission rate system as their approach to——

Mr. SANT. They would adopt emission rates as a means of implementing the cap, and they would allow conservation offsets, so that they, you know, they would allow a utility to say, well, I'd like to a combination of scrubber technology and conservation that will achieve the same rate as I would have achieved otherwise. But the State, then, is talking about an overall cap. Their implementation may indeed be what Mr. Trisko is arguing or other people would argue. But I think that should be left to the State to try to allow the most flexible approach to achieving that result as possible, because I think ultimately we're saying that total emissions are what we're concerned about. We're not concerned about rates. That's just a means of getting to some objective. So perhaps that would work.

I don't know about the offset idea. That may be complex, but clearly you could do it just as much as you could do it with any other kind of pollutant offset.

Mr. SHARP. Well, simplistically it seems to me what you've told us is that the State has the choice of going either direction. But under the scheme of emission rates, you foreclose or limit substantially the possibility of conservation.

Now Mr. Trisko obviously——

Mr. SANT. I'm not worried about his problem of interstate transactions. I think that could be handled by the producer paying for it. That's the cost of him having to ship it to the other State. He pays for that cost anyway, because that's where the emissions are occurring.

Mr. SHARP. Well, of course, you may well have a State government that wants to aggressively go after those plants that sell electricity interstate. I mean, if their concern is less for the utility's interstate business and more for the domestic parochial ratepayer, they may play off against each other.

Mr. GELLER. You could also talk about interstate trading and allowing the receiver of the power to provide some emissions reductions to offset the increased emissions that they're creating in the producer's State.

Mr. SHARP. Mr. Trisko?

Mr. TRISKO. Mr. Chairman, in connection with the total loadings approach, there appears to be an overlooked issue, and that is, of course, the Clean Air Act, as we've recognized at this hearing, is composed largely of an emission rate approach. Congress chose the emission rate approach when it balanced the competing environmental and economic concerns. It wanted to avoid the limitations on economic growth which could be associated with a tonnage, total tonnage type limitation.

If Congress today were to decide that a total tonnage limitation for one pollutant, sulfur dioxide, is appropriate to deal with the acid rain problem, then it seems appropriate for Congress at the same time to go back and carefully reexamine other programs under the Clean Air Act which would in effect be rendered moot as a result of that decision, such as the tall stack policy, the prevention of significant deterioration policy. Indeed, under a true cap, even the basic new source performance standards themselves. Those policies would no longer have vitality or a useful purpose in the context of the Clean Air Act with a total tonnage limitation.

Mr. SHARP. Gentlemen, we're going to need to go vote, and I appreciate your time and attention to this issue. We may have some follow-up inquiries with you about the mechanics and possibilities of these divergent approaches. Thank you very much for your time.

[Whereupon, at 11:54 a.m., the subcommittee was recessed, to reconvene at the call of the Chair.]

[The following information was received:]

# The Impacts of Energy Conservation on Sulfur Emission Reduction Programs for Ohio Electric Utilities

## SUMMARY

A REPORT PREPARED BY

Office of the Consumers' Counsel
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# THE IMPACTS OF ENERGY CONSERVATION ON SULFUR EMISSION REDUCTION PROGRAMS FOR OHIO ELECTRIC UTILITIES

## SUMMARY

This report identifies impacts which expanded energy conservation programs, comparable to those in other states, could have in Ohio and a major role such programs could play in implementing acid rain control legislation. Energy conservation, particularly when combined with least emissions dispatching, a strategy which conservation complements, could cut the cost of sulfur dioxide ($SO_2$) emission controls in Ohio by as much as 60%, while keeping Ohio coal use at or above current levels.

Since the energy crisis of the 1970's, there has been a profound technological change in the efficiency with which we use energy. Today, more efficient buildings, appliances and motors provide improved services using only a portion of the energy consumed by their 1970's counterparts. These improvements in energy efficiency, and the potential to carry them forward, have become America's single most important energy resource.

This report is the product of a more than year long study of including energy conservation as part of Ohio's implementation strategy for acid rain control. The study analyzed the potential of seventy-two specific conservation measures in the residential, commercial, and industrial sectors. It modeled the impacts of both modest and more aggressive conservation programs and analyzed a range of $SO_2$ reduction requirements, including those contained in the recent Celeste/Cuomo proposal.

## I. ACID RAIN: A NATIONAL PROBLEM

Since the 1981 National Academy of Sciences report,[1] there has been increasing agreement that acid rain is a national problem which requires federal action. At least twenty bills addressing acid rain have been introduced in the 100th Congress. Most would require significant reductions in utility $SO_2$ emissions of 8 to 12 tons, and in $NO_x$ emissions of 0 to 4 million tons between 1993 and 2003. Congressional consideration has advanced further than in any preceeding Congress. Moreover, the probability of federal action does not seem likely to dissipate with both leading 1988 presidential candidates having indicated support for stronger controls.

Significant $SO_2$ and $NO_x$ emission reductions could impose substantial costs on states in the lower midwest which both rely heavily on coal fired electrical generation and contain regions which are economically dependent on high sulfur coal production. The Office of Consumers' Counsel (OCC) Governing Board has taken the position that acid rain control legislation should be fair and cost-effective and supported efforts to identify lower cost alternatives for implementing $SO_2$ and $NO_x$ controls. The OCC Governing Board has specifically urged that acid rain control legislation give full credit to emission reductions achieved through energy conservation.

To date, the principal methods proposed for reducing these emissions have been to retrofit Flue Gas Desulfurization equipment (Scrubbers) on existing coal fired utility power plants and to switch these plants to lower sulfur coal than is generally found in Ohio. Scrubbers achieve a very high sulfur removal efficiency (over the 90%), but are costly to install and reduce the net output of the plant by 5%. Fuel switching achieves reductions with a minimum of up-front investment. But fuel switching could result in significant increases in fuel costs escalating over time, achieves lower emission reductions than scrubbers, and could cause a significant decline in the demand for high sulfur coal. Large reductions in high sulfur coal demand could create substantial job losses and dislocations for Ohio coal miners.

Ohio has undertaken, with OCC's support, an extensive clean coal technology development program, in response to the limitations of existing control options. Our findings indicate that energy conservation is a valuable additional control strategy, consistent with the extensive deployment of clean coal technologies.

## II. ENERGY CONSERVATION: AMERICA'S BEST KEPT ENERGY SECRET

For purposes of this study, energy conservation does not mean lowering thermostats or wearing extra clothing in winter. Conservation means requiring less energy to achieve an equal or improved level of service, comfort, and convenience through using more energy efficient technologies.

Historically, increasing demand for energy was thought to be an unavoidable result of economic growth. Since the energy crisis of the early 1970's, however, Americans have enjoyed a 35% increase in GNP without increasing their use of energy.[2] The improvements in energy efficiency which have occurred since 1973 have cut annual U.S. energy expenditures by $150 billion.[3]

The following examples are representative of the type of improvements which have occurred:

- The average 16 to 18 cubic foot frost-free refrigerator used 1,900 kilowatt hours (Kwh) of electricity per year in 1977. By 1985, average new refrigerators used only 1,166 Kwh per year. And, in 1990, recently enacted federal appliance efficiency standards will reduce average annual electricity usage for new refrigerators to 900 Kwh.

- In the early 1970's it was not uncommon for new large office buildings to annually use 400,000 Btu of primary energy per square foot (total energy used for heating and fuel needed for electrical generation). Through a system voluntary national standards, construction of buildings which use no more than 100,000 Btu per square foot should soon become the norm.[4]

Additional efficiency improvements are well within our grasp. Offices and homes currently account for $112.5 billion of the nation's total yearly electrical energy bill. A variety of studies suggest that as much as $50 billion can still be trimmed from these costs by employing already proven, cost effective conservation measures.[5] While U.S. industrial energy use per unit of industrial value added fell at an average rate of 2.4% per year from 1973 to 1985, U.S. industry continues to use energy at twice the rate of its Japanese and West German competitors.[6]

Remarkably, the efficiency improvements of the last fifteen years have occurred despite major market imperfections. To overcome the failure of the market to provide consumers appropriate price signals, more than fifty utilities have implemented large scale informational and rebate programs.[7] Such programs are designed to encourage the purchase of energy efficiency measures.

## III. THE IMPACTS OF ENERGY CONSERVATION ON $SO_2$ REDUCTION PROGRAMS.

The results presented in this report are based on technical analyses prepared by consultants Howard Geller and Peter Miller of the American Council for an Energy Efficient Economy and Eric Miller of AES Environmental Services.

### A. Energy Conservation Without Mandated $SO_2$ Controls

Conservation programs could avoid the costs of operating the utilities' more expensive generating capacity and defer capacity additions. As a result, the conservation programs modeled in this study would produce net savings for consumers every year they would be in operation. This occurs even during the early years of the program when Ohio utilities would have excess generating capacity. Total electricity costs for industrial customers could be reduced by almost $2.5 billion between 1987 and 2007, if an aggressive conservation program where implemented. Meanwhile, residential consumers could experience savings in the area of $5 billion by 2007. Commercial customers could experience a $1.8 billion reduction in electricity costs.

### B Impacts of Energy Conservation on $SO_2$ Control Programs

This analysis identified a strategy for implementing $SO_2$ emission reductions in Ohio which could sharply reduce the cost of emission controls, while preserving or increasing from current levels the use of Ohio coal. Specifically, adding a combination of more aggressive conservation programs and least emissions dispatching could cut the annual cost of $SO_2$ controls by about 60% compared to more traditional $SO_2$ reduction strategies. For a typical 10 million ton reduction proposal, this means reducing annual Ohio compliance costs in 2005 from $680 million to $270 million. This same conservation, least emissions dispatching approach could ensure an increase in the use of Ohio coal to 6% above current levels at 2007. This would preserve thousands of coal related jobs which could be lost using a more conventional (scrubber/fuel switching) compliance strategy. These results assume $SO_2$ control requirements which establish a tonnage ceiling on emissions.

Pursuing an aggressive conservation strategy would keep Ohio $SO_2$ emissions at or below current levels (2.2 million tons annually) through 2007, avoiding a forecasted increase in $SO_2$ emissions to 2.5 million tons by 2005. By avoiding the most expensive emission control measures, conservation reduces the annual cost and the cost per ton of $SO_2$ removal and lowers long-term electricity prices as indicated for the two phase emission ceiling cases in Table 1.

TABLE 1

Annual Cost of Emission Control Programs, Cost Per
Ton of $SO_2$ Reductions, and Electricity Prices
Relative to Base Case - No Reductions
Two Phase Emission Ceilings

| | 2005 Annual Cost (Million $) | 2005 Cost Per Ton ($/Ton) | 2005 Price Increase (%) |
|---|---|---|---|
| Base Case Load Growth | | | |
| Designated Scrubbers | $680 | $391 | 7.3% |
| Low Cost | 760 | 434 | 8.2% |
| Least Emissions Dispatch, Designated Scrubber | 530 | 303 | 5.6% |
| Moderate Energy Conservation | | | |
| Low Cost | 670 | 427 | 3.6% |
| Aggressive Energy Conservation | | | |
| Designated Scrubbers | 540 | 370 | 4.6% |
| Low Cost | 580 | 397 | 5.1% |
| Least Emissions Dispatch, Designated Scrubber | 270 | 194 | 1.2% |

The aggressive conservation program by itself reduced the annual cost of $SO_2$ control by 21% to 49%. It also gives utilities greater flexibility in choosing which generating units to operate, enhancing their capability to emphasize use of the cleanest units. Least emissions dispatching is a system under which an electric utility maximizes the use of generating capacity from cleaner burning facilities, and minimizes the use of its facilities that are heavier polluters. Our least emissions dispatching approach is based on making optimal use of those units on which scrubbers would still be required.

The results for the $SO_2$ control cases provided dramatic evidence of long-term cost effectiveness of conservation programs. In all aggressive conservation emission ceiling cases, the additional savings from avoided capacity and operating costs were large enough to completely offset the cost $SO_2$ controls. Through 2005, Ohio consumers could actually reduce their cumulative cost for electrical energy services by as much as $3 billion with aggressive conservation and stringent emissions controls in comparison to what they would pay with no conservation or emissions controls.

In this study, conservation programs are begun in 1990 at a time when Ohio is not projected to need new resources. As a result, the demand reductions created by the programs could temporarily increase average electricity rates per Kwh slightly (1% to 5%) above what they would be in the absence of conservation. It is important to remember that at no time does the average consumer see higher monthly bills. The reduced energy use from conservation more than offsets any rate increases, even during the early years of the program. The temporary increase in rates could continue until 2001 to 2003, when the savings from avoided new construction will cause rates in the conservation cases to fall significantly below those in the base case load growth scenarios. We would expect rates to continue falling relative to base case load growth prices for some time after 2007. By 2005, $SO_2$ reductions under the conservation/least emissions dispatch cases would produce only a 1% increase in rates compared to the base case with no emission reductions.

The results also indicated that the contribution of energy conservation to reducing the cost of $SO_2$ control was substantially greater when emission reduction requirements were structured as a ceiling on total tonnage, rather than as a cap on emission rates per unit of heat input, and when more time was allowed for conservation to have an impact under the 30 year/1.2 emission reduction requirement.

Given what we believe to be the most credible assumption regarding the increases in low sulfur coal prices, we found little long-term difference in the cost to consumers of control strategies which relied more heavily on fuel switching and those which relied more heavily on scrubbers.

When emission reduction requirements were modeled as a tonnage ceiling on SO$_2$ emissions, conservation had little or no net impact on high sulfur coal use. In the aggressive conservation, designated scrubber, least emissions dispatch cases, high sulfur coal use remained at or above current levels throughout the period studied. By 2005, the addition of aggressive conservation and least emissions dispatching resulted in 16% greater use of Ohio than reliance on scrubbers alone.

When other control strategies were tested, significant reductions in high sulfur coal use were projected, but when reduction requirements were specified as a tonnage ceiling on emissions virtually identical reductions were projected to occur regardless of whether conservation was or was not included in the control strategy.

## C. Celeste-Cuomo Proposal

Adding the combination of conservation programs and least emissions dispatching into an Ohio implementation strategy for the Celeste-Cuomo acid rain proposal produced some of the promising results found in this study. Including aggressive conservation and least emission dispatching in Ohio's implementation strategy reduced the cost of SO$_2$ controls by 62% to 69%. Ohio coal would gradually increase to 6% above current levels by 2003. By comparison, a more conventional strategy which relies heavily on scrubbers could produce up to a 13% decline in Ohio coal consumption from current levels.

TABLE 2

SUMMARY OF CELESTE-CUOMO PROGRAM IMPACTS

| | Ohio Coal Use Relative to 1987 Levels | | | Annual Cost Per Ton ($/Ton) | | | Annual Cost of Emissions Control (Million $) | | | Average Electricity Price Increase (%) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1995 | 2000 | 2005 | 1995 | 2000 | 2005 | 1995 | 2000 | 2005 | 1995 | 2000 | 2005 |
| Base Case Load Growth Scenario<br>Celeste-Cuomo 3 Phase<br>Emission Ceiling:<br>Designated Scrubbers | 10% | 2% | -10% | 342 | 331 | 386 | 250 | 430 | 680 | 2.8% | 5.0% | 7.3% |
| Aggressive Conservation Scenario:<br>Celeste-Cuomo 3 Phase<br>Emission Ceiling:<br>Least Em. Disposal,<br>Designated Scrubbers | -1% | 3% | 6% | 98 | 120 | 190 | 50 | 120 | 280 | 8.1% | 9.3% | 1.4% |

SUMMARY OF CELESTE - CUOMO PROGRAM IMPACTS
1993, 1998, 2003

| | ANNUAL COST OF EMISSIONS CONTROL (MILLION $) | | | OHIO COAL USE RELATIVE TO 1987 LEVELS (%) | | | AVERAGE ELECTRICITY PRICE INCREASE (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1993 | 1998 | 2003 | 1993 | 1998 | 2003 | 1993 | 1998 | 2003 |
| BASE CASE LEAD GROWTH: | | | | | | | | | |
| DESIGNATED SCRUBBERS | 260 | 450 | 660 | 7% | 1% | -13% | 3.0% | 5.4% | 7.4% |
| AGGRESSIVE CONSERVATION: | | | | | | | | | |
| DESIGNATED SCRUBBERS, LEAST EMISSIONS DISPATCH | 80 | 140 | 250 | -1% | 1% | 6% | 6.0% | 10.4% | 4.7% |

Under the Celeste-Cuomo national cost sharing proposal, the study projects that Ohio would receive cumulative payments (1987 $) totaling $1.1 billion through 2003 under a base case load growth scenario. This would equal 22% of $SO_2$ control costs paid by consumers through 2003. In the conservation, least emissions dispatch case cumulative transfers to Ohio would equal 0.9 billion through 2003, or 50% of the $SO_2$ control costs paid by consumers through that date.

The Celeste-Cuomo proposal provides for tonnage ceilings for Ohio and other heavily impacted states, which is the form of emission control with which conservation has the greatest potential. Moreover, the timing of reductions would give conservation programs a chance to work.

D. Methodology:

This study has two principal components. First, since no recent analysis of the technical potential for energy conservation in Ohio existed, an Ohio specific study of conservation potential was completed. This study paralleled earlier work done for the ECAR region.[8]

The conservation potential analysis reviewed 75% of Ohio electric consumption and evaluated existing technologies for improving the efficiency of energy use in the residential, commercial and industrial sectors. This analysis indicated that measures with a cost of 6 cents or less per Kwh saved had the potential to reduce annual energy use by 26,966 Gwh or 22% of 1986 consumption.

Second, an integrated planning model was used to develop base case and conservation load forecasts and to predict the impacts of conservation programs under a range of $SO_2$ reduction requirements and compliance strategies. The analysis used a systems dynamics model similar to models used in to prepare forecasts for the U.S. Department of Energy and to evaluate conservation potential for the Bonneville Power Administration.

The model forecasted base case average annual load growth of 1.5 percent, closely paralleling utility forecasts. In the moderate and aggressive conservation cases, energy use was forecasted to grow at 1.0% and 0.7% per year respectively. The forecasted reductions in load growth in the conservation cases are comparable to savings reported by large utility conservation programs.[9]

The measures selected for inclusion in conservation programs were cost effective in reducing total energy costs independently of whether $SO_2$ reductions were required. The average conservation costs in the moderate and aggressive conservation cases were 2.07¢ and 2.65¢ per Kwh saved respectively.

The study considers rate caps, tonnage ceilings, and elongated emission reduction requirements as well as the $SO_2$ control portion of the Celeste/Cuomo proposal. Against these $SO_2$ reduction requirements, the study evaluated, with and without conservation, control strategies which relied heavily on fuel switching (a low cost strategy at 1985 generation levels); scrubbers (at designated units under 30 years of age); and a combination of scrubbers and least emissions dispatching (base loading scrubbed units).

## IV. CONCLUSIONS AND RECOMMENDATIONS

The results of this study suggest areas for further research and have a number of important policy implications:

A. Aggressive energy conservation, particularly in combination with the complementary strategy of least emissions dispatching, could have a significant impact on reducing emissions growth, cutting the cost of $SO_2$ control, and preserving Ohio coal production.

B. Acid rain control legislation must be fashioned to accommodate energy conservation as an emission control strategy.

1. To give full credit to conservation related reductions in atmospheric $SO_2$ and $NO_x$ loadings, statutory requirements must be structured as a ceiling on the tonnage of emissions allowed. Tonnage ceilings limited to non-NSPS units or based upon available capacity can avoid objections that a ceiling on total emissions could limit economic growth.

2. Legislation should not limit allowable compliance strategies. Even if conservation is listed as an acceptable strategy, verifying that emission reductions are attributable specifically to conservation could require years of litigation.

3. Legislation should give specific direction to U.S. EPA to accept projected conservation program results incorporated in state load forecasts, provided adequate contingency planning is contained in the State Implementation Plan (SIP). Contingency planning will be required to implement any legislation. State regulators are in a better position than U.S. EPA to evaluate the potential of conservation programs.

4. Legislation should specifically include provisions to allow trading and resolve disputes regarding the allocation between states of conservation related emission reductions in multi-state utility systems and power pools. Two types of proposals have been suggested: an arbitration system administered by U.S. EPA or the federal assignment of separate emission ceilings to multi-state utilities and power pools.

5. A system of limited emission reduction banking which offered flexibility for unexpected changes in energy consumption while achieving cumulative loading targets could be considered as an option to facilitate compliance with emission controls based upon a tonnage ceiling.

6. Compliance and planning deadlines must be sufficient to allow states to develop conservation program capabilities and achieve significant load growth moderation.

7. In the development of U.S. EPA implementation guidance, coordination between EPA and the states would be desirable. Both a state advisory committee to EPA and federal assistance to states in the development of conservation capabilities could prove valuable.

C. Conservation underscores the need for increased coordination among state air quality authorities, utility regulators, and energy offices in acid rain SIP development and implementation, including:

1. Integration of official load forecast and SIP development to incorporate conservation impacts;

2. Forecasting of dispatching and generation patterns to support SIP development and implementation; and

3. On-going data exchange regarding load growth to fine tune conservation programs and determine when emissions control contingency plans should be implemented.

D. Prompt consideration should be given to steps to build the capability of Ohio electric utilities to undertake effective energy conservation programs.

By now, it's no secret that improving the efficiency of electricity use in Ohio could dramatically reduce the cost of environmental control, increase the competitiveness of Ohio industry and business, and lower energy costs for all of its citizens. Federal legislators, state planning authorities and utilities should take full advantage of Ohio's conservation resource. It is an opportunity we all cannot afford to miss.

## FOOTNOTES

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# ACID RAIN OVERSIGHT

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MONDAY, JUNE 20, 1988

House of Representatives,
Committee on Energy and Commerce,
Subcommittee on Energy and Power,
*Indianapolis, IN.*

The subcommittee met, pursuant to notice, at 10:05 a.m., in the Fourth Floor Auditorium, Indiana Vocational Technical College (Ivy Tech), 1 W. 26th Street, Indianapolis, IN, Hon. Philip R. Sharp (chairman) presiding.

Mr. Sharp. This morning's hearing on acid rain is a very important occasion. In this city, we are nearly in the center of the region that would be most affected by any acid rain control legislation. This is the battleground. Whether the debate occurs in Washington or here, Hoosiers and other Midwesterners will bear the heaviest burden in solving the acid rain problem.

The Subcommittee on Energy and Power has the responsibility of looking at this issue. We share that responsibility with the Health and Environment Subcommittee. I think that we—no matter what point of view the members start from—may look at the issue somewhat differently than our sister subcommittee.

At the Health Subcommittee hearings here in Indianapolis in 1984, the emphasis was on the environment and whether or not acid rain was a problem at all, whether the source receptor relationships were clear and whether Congress should impose extraordinary costs in the absence of better information.

At our science hearing last month, the scientists were very helpful in telling us where the research has led us. The panel of respected scientists representing a broad range of viewpoints found much on which to agree. They told us, for example, that acid rain has been definitely implicated in the acidification of certain lakes and in corroding building surfaces. They also told us, however, that current levels of acid rain do not cause crop damage, and that the role of acid rain in forest damage is unknown at this time. Other pollutants—including ozone and its precursors or components—definitely play a role in crop damage and may be implicated in forest damage.

In addition, and perhaps most important in the current legislative debate, the scientists emphasized that there are no magic numbers—no magic formula of the number of tons reduction and no absolute date by which the reductions must be accomplished. They agreed that reductions in sulfur emissions are beneficial, but they gave us no inflexible solutions or absolutes about what we have to do.

Those who argue that an acid rain bill must reduce 12 million tons of sulfur and must do so within 10 years may have a basis for their arguments—but that basis is not science.

Our second hearing also took a different approach from past hearings. Last week we heard from those who advocate a role for energy conservation as a way to reduce the costs of acid rain control. This option would actually be ruled out by some of the legislative proposals before us. One witness testified that costs could be cut by 10–40 percent in our region—should any acid rain legislation pass—if conservation were an option for compliance. That means sulfur emissions could be reduced through conservation—through using less electricity.

This subcommittee has tried to focus, in its hearings, on issues that the Health Subcommittee may have neglected, on questions asked somewhat differently, on seeking new answers to this problem.

As a Hoosier, I wish this issue did not occupy so prominent a place on the public agenda. But I want our State and its diverse interests well represented at the table when and if decisions that affect us are made. That is why the subcommittee is here today.

I think all our witnesses today have an important story to tell. We are grateful to them for taking the time to come here today as well as to those whom we were unable to invite to present oral testimony. To those who submitted written statements for the record, our thanks as well. They will be made a part of our permanent hearing record and I am sure will be of help in any future policy decisions.

This hearing will address the issue of buildings, and some additional information on the issue of lakes, which has driven this question on the national agenda.

I believe second that the Congress, in trying to base its thinking first on scientific information, ought to seek out the least costly way in which to accomplish whatever goal is finally established. And it is very important for people to understand there are different ways to skin this cat, and they do make a difference in terms of the costs that are borne, and my own parochial interest is that we help keep those costs down here in this State.

Third, this is viewed by its advocates as a national problem that goes beyond simply human health concerns, which has been the driving force for most of the clean air actions; and therefore I think any action that Congress should take should have a national solution that recognizes that the contributions to sulfur dioxide and nitrogen oxide are very broad-based in this country, not simply in the Midwest, and that the costs for cleanup ought to be borne on a very broad based system in this country to help solve what some view as a major national problem.

I am very pleased to welcome other colleagues of mine from the subcommittee and the full committee.

From Indiana, Congressman Dan Coats. He is not any longer a member of this subcommittee, but he is a very prominent member on the full Energy and Commerce Committee and I will recognize him in a moment for a statement.

Our colleague from the State of Washington, who is a member of this subcommittee, is a leader in a group called the Group of Nine which has been seeking out compromise solutions on a whole range of clean air issues that are before the Energy and Commerce Committee, Congressman Al Swift; and a distinguished colleague of ours from the State of New Mexico, Congressman Richardson, who actually has a prominent role as Co-Chairman of the Democratic National Platform Committee and may have something to say about what the language is in the platform. While that is not our goal here, to shape that platform, it may influence his thinking on legislation. And I take that very seriously in terms of his role in this subcommittee.

I would like to now recognize my colleague from Indiana, Mr. Coats, for an opening statement.

## STATEMENT OF HON. DAN COATS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF INDIANA

Mr. Coats. Thank you very much, Mr. Chairman. I appreciate the opportunity to be invited to participate on this subcommittee, on which I used to serve under your chairmanship. And now I have switched over to the Health and Environment Subcommittee, which is currently marking up Acid Rain legislation. I appreciate your continuing interest in a subject that is vital to the State of Indiana, and particularly your allowing me to be part of this hearing in Indiana to assess better what the impact of this legislation or other proposed legislation might be on our State.

I also want to welcome my two colleagues from the Energy and Commerce Committee, Congressman Richardson and Congressman Swift, to Indiana. I hope you have an opportunity to enjoy some Hoosier hospitality while you are here and I am glad that you are here to learn about the impact of this legislation on the people of our State.

I think it is important that we do this because rarely has an issue come before our committee or before Congress that has provoked as much controversy or is perhaps as little understood as the acid rain issue.

We in the Midwest, of course, are vitally concerned about this, because the impact of proposed legislation has such a devastating impact on the people of our State and our economy.

We are talking about a multi-billion dollar solution to a problem and a considerable amount of that cost is going to be borne by the people of the Midwest region.

The Indiana Department of Environmental Management has submitted information, and we may hear more about that today, estimating that the proposed legislation before us could cost Hoosiers 10,000-plus jobs in the future—nearly 1,000 in the coal industry and about 5,000 in various manufacturing industries.

The basic industries in our State, of which we have many, use large quantities of electrical power. And most of that electrical power is coal generated.

Those industries are competing on a world-wide basis, and it comes down often to a matter of just dollars and cents in terms of their ability to be competitive.

One of the features of locating a plant in Indiana or operating a business in Indiana is the ability to obtain energy at a reasonable cost. That is a major factor in the decision of a number of our manufacturers to either locate here or to expand their existing business here. And I am sure we will hear testimony on that later on.

The auto industry, which has a significant role in Indiana, would be severely impacted by the legislation before us, because not only will they have to comply with industrial boiler requirements, with increased utility costs, they also would have to comply with mobile source emission standards that would be imposed by this legislation.

Some have told me they have serious reservations about their ability to comply with these new standards and to meet the timetables prescribed by the bill. The American Farm Bureau has estimated increased costs to Indiana farmers of up to 20 to 25 percent in the energy area. This is particularly impacting on those who use large amounts of electricity for crop drying, heating and irrigation pumping. We will hear testimony today, I am sure, about the impact on Indiana's coal industry and then finally on the consumers of Indiana who would also have to bear substantial increases in cost if this legislation were adopted.

As you said, Mr. Chairman, in the beginning, it is important that we base any proposed solution to the problem that we face on the soundest scientific evidence that we can make available. Congress and the Government are undergoing a massive undertaking, spending hundreds of millions of dollars on a 10-year study to give us the science that we need to make rational, intelligent solutions.

That study is well along and will be completed in the next couple of years and I would hope that we would have the patience to wait for the conclusions of that study before we rush to judgment as to what we ought to do, particularly with the impact that it has.

The interim study that was just recently released less than a year ago by that group indicated that we do not face the kind of environmental crisis that would lead us to seek a quick, temporary solution, and perhaps a solution that might not be all that viable. We do have time. We do have the luxury of waiting for the science. We do have the time to study this situation very carefully. And I think we ought to do that. This is part of that process. And I commend you for bringing it to Indiana.

Thank you, Mr. Chairman.

If I could, I would like to ask unanimous consent to submit my entire statement and also submit a statement from Senator Quayle, who could not be here but wanted to have a statement entered in the record.

Mr. SHARP. Without objection.

[The prepared statements of Mr. Coats and Mr. Quayle follow:]

### PREPARED STATEMENT OF HON. DAN COATS

Mr. Chairman, I want to commend you for calling this hearing today which will examine the effects of proposed acid rain control legislation on the Midwest, and specifically Indiana. I would also like to thank you for allowing me to participate in this hearing by the Energy and Power Subcommittee. While I do not serve on the Energy and Power Subcommittee, I am a member of the full Energy and Commerce Committee, as well as a member of the Health and Environment Subcommittee, as is my colleague Mr. Walgren of Pennsylvania.

I would also like to welcome Mr. Walgren to Indiana, as well as my other Energy and Commerce colleagues, Mr. Swift of Washington and Mr. Richardson of New

Mexico. I am sure you will enjoy traditional Hoosier hospitality while you are in our State.

Mr. Chairman, rarely has an issue come before Congress that has been as divisive, as poorly understood and as controversial as the subject of acid rain. It has divided the scientific community. It has pitted regions of the country against one another, and caused major disagreements within political parties.

I continue to believe that this is not the time to pass such sweeping legislation, which would be devastatingly costly to midwestern States, and which we have no reason to believe would solve the environmental problems that are linked to acid rain precipitation. To impose a multi-billion dollar acid rain control program, clamping down on emissions in the Midwest, only to find out later that it has not solved the problem does not appear to me to be the rational way to proceed.

Annual estimates for compliance with the proposed legislation range from $4 billion to over $9 billion. Indiana is significantly impacted by the provisions of this legislation. In the employment area alone, the Indiana Department of Environmental management estimates that over 10,344 jobs will be lost as a result of legislation currently under consideration by the committee, including 986 in the coal mining industry, and 4,820 in various manufacturing industries.

As you know, Mr. Chairman, Indiana, like most States in the Midwest, was severely impacted in the 1982–1983 recession. Through a great deal of hard work by a number of people in this State, we have made a remarkable recovery. A major factor in our success has been the ability to offer reasonable energy costs, a key component of Indiana's manufacturing industry.

Basic industries that use large quantities of electrical power and fossil fuels are facing foreign competition today. And I do not have to remind my colleagues that this foreign competition is intense, and that we are trying to save dollars wherever we can to make our industries competitive.

For instance, the auto industry, so important to Indiana's economy, would be severely impacted by this legislation. Not only would the industry absorb the additional costs of industrial electric rate increases, but under most proposals it must also absorb compliance costs of the industrial boiler provisions, the industrial process emission reductions, as well as deal with the costs and potential production restrictions associated with the bill's mobile source provisions for nitrogen oxides ($NO_x$).

This is in spite of the fact that the auto industry has already contributed significantly to the clean up of our Nation's environment. Federal laws and regulations limit exhaust and evaporative emissions from automobiles and trucks. I understand these controls have reduced auto exhaust emissions of $NO_x$ by 76 percent from amounts emitted by pre-1969 uncontrolled vehicles. I am concerned that these new standards impact on the two dozen automotive plants located both in my district and in other parts of Indiana.

I am especially fortunate to have a new truck assembly facility built on 935 acres in my district. This new 2.1 million square foot facility has provided a tremendous boost for the economy of Northeastern Indiana. The plant began production in late 1986, and currently employs over 3,000 people. When the two-shift operations are operating at full capacity, it will produce about 230,000 vehicles annually. Yet the viability of this new facility could be endangered both by the proposed new stationary source controls and the emissions standards for light-duty trucks.

From an agricultural perspective, this bill will have a negative effect on net farm income because of the resulting significant increase in agricultural production costs. The American Farm Bureau has stated that estimates of 20–25 percent for electrical rate increases for commercial uses could result in "severe hardship for farmers and ranchers, especially those who use large amounts of electricity for crop drying, heating or irrigation pumping."

Even more severely affected would be the coal industry. The Indiana Department of Environmental Management anticipates that at least 3.4 million tons per year of local high-sulfur coal by out-of-State low-sulfur coal. This is a minimum estimate of the potential for switching, and the actual amount could be much higher.

Mr. Chairman, recent information from both the 1986 Annual Report of the National Acid Precipitation Assessment Program (NAPAP) and testimony before the Energy and Commerce Committee demonstrates that we are not facing an immediate environmental crisis. Research to date indicates we have time to develop a well-targeted, effective response to our environmental protection needs.

With each passing year our knowledge grows. Sulfur dioxide emission rates are declining, and will continue to decline into the next century. Necessary research is underway, and should be completed in the next 2 years. All preliminary indications are that the news is good, and getting better. There is certainly no evidence that a crisis solution is needed at this time.

In light of this uncertainty, we must ask whether some alternative solutions are now available or might become available, which can provide both a more efficient and a lower-cost means of addressing this problem. I believe that clean coal technology alternatives offer a more economically and scientifically realistic alternative to sulfur dioxide emission controls. While these techniques are not yet fully developed, precipitous controls which will expend the funds and energies of Midwestern utilities will only serve to delay their development further. I understand that the Energy and Power Subcommittee will be holding a hearing this Wednesday on the Clean Coal Technology Program, and I would like to commend you, Mr. Chairman, for your support for this program.

I would like to summarize my statement by re-stating my opposition to acid rain control legislation for three reasons: First, there is insufficient evidence to demonstrate that acid rain is an environmental problem justifying the "crisis mode" attitude taken in the proposed acid rain legislation.

Second, we have spent hundreds of millions of dollars to fund a credible study which scientifically demonstrates the extent of the acid deposition problem, and which makes realistic suggestions for its solution. The final version of this study will be released in less than 2 years, and I believe we should get our money's worth out of this study by waiting to learn its conclusions before imposing a solution on this country.

Third, there is insufficient scientific evidence to support drastic emissions reductions in the Midwest as a means of neutralizing a few lakes in the Northeast. The point here is cause and effect, Mr. Chairman. We cannot prove the cause and effect between sulfur dioxide emissions in the Midwest and aquatic damage in New England.

We are concerned about the environment. We want to clean it up, to do our part. We are already doing our part by spending a tremendous amount of money to achieve these reductions, by funding a massive study of the problem and by pursuing an aggressive clean-coal strategy. Let's have a sound scientific basis for making whatever policy decisions we have to make, and then go forward and develop a proper solution to this problem. Let's not impose a drastic, short term solution now that we may regret later.

Thank you, Mr. Chairman.

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## Prepared Statement of Senator Dan Quayle

Mr. Chairman, and Members of the Committee:

Acid rain is a subject of fundamental importance and concern in Indiana as well as the rest of the Nation. I am appreciative of the chairman's efforts to bring this subcommittee to Indianapolis to hear first hand the views and concerns of Hoosiers. Indiana has a very large stake in the outcome of any acid rain debate. I regret that I am unable to attend today's hearing to deliver my testimony personally.

I believe that proposals to control sulfur dioxide emissions as a solution to the acid rain problem, such as those now under discussion in Congress, are premature and cannot guarantee to solve the problem. I do not believe the coal-producing and industrial States of the Midwest should be required to foot the bill for the most expensive and comprehensive experiment in atmospheric science ever.

I am not convinced that there are as yet conclusive data that sulfur dioxide emissions in the Midwest are the primary source of acid rain in the Northeast. Nor is there sufficient scientific evidence that distant-source controls can reverse lake acidification. The NAPAP (National Acid Precipitation Assessment Program) interim assessment issued last year found that "$SO_2$ reductions are unlikely to result in a decrease in acid rain in the Northeastern United States." The report did not foresee any significant change in watersheds at current deposition levels.

Furthermore, sulfur dioxide emissions have decreased by almost 30 percent in the last 12 years, even at a time when coal usage vastly increased. The downward trend is continuing. This emission reduction has not come inexpensively. The United States currently spends $30 billion annually on air pollution control alone.

While our scientific understanding is not complete, our current knowledge does not justify implementation of the control strategies being proposed in Congress. In congressional testimony, EPA Administrator Lee Thomas summarized the state of our current scientific understanding:

"Acid deposition has damaged a limited number of aquatic systems in this country and accelerates wear and weathering of building materials to an unknown extent. However, to the best of our knowledge acid deposition at current levels is causing very gradual or no additional damage. The possibility of widespread damage to forests due to acid deposition alone has not be demonstrated . . ."

In short, there is no crisis that demands new, draconian regulation.

There is one aspect of the acid rain debate that I think is sometimes overlooked. What are acid rain controls going to do to our energy security and international competitiveness? This needs to be fully examined and detailed.

In Indiana, more than 98 percent of the electricity generated comes from coal-fired powerplants; 88.2 percent of the electricity consumed in Indiana is produced by coal-fired powerplants. Coal is an abundant, domestic resource. It is not supplied by the Mideast, or subject to the vagaries of Ayatollahs, or used as a political weapon in world events. Its use does not require the same expensive safety precautions as does energy provided from nuclear fuel.

Acid rain controls will have a significant effect on coal's contribution to our energy mix, even more so if stringent controls are enacted before the results are known of our Clean Coal Technology Demonstration program. I have strongly supported the Clean Coal Technology program because I think that part of the resolution of the acid rain dilemma is in improved technology to utilize coal in a more energy and environmentally efficient manner.

In terms of international competitiveness, Indiana has many industries that are very energy intensive. Acid rain controls will cost Indiana utilities millions of dollars. Electric utility rate increases, which have been estimated at a 36.5 percent Statewide average increase, will be borne by the ratepayers. To industrial customers, this increases the cost of doing business and thus decreases the competitiveness of their products and could dampen expenditures for research and development of improved products. Many Indiana companies, those in automobile manufacturing, steel and metal production, and agriculture, face stiff foreign competition and would be adversely affected by acid rain controls.

In human terms, these rate hikes would make it very difficult for individuals—especially those on fixed incomes, our senior citizens and low-income workers—to make ends meet. For others, acid rain controls might mean the loss of a job in a coal mine or a layoff in a company hurt by reduced competitiveness. Because Indiana's coal production is localized within the State, any downturns as a result of acid rain controls will be felt sharply by all. Indeed, the Congressional Research Service has stated the situation well—one is not talking so much about mining jobs as "one is talking about the economic viability of selected communities."

Finally, let me say a few words about the legislation pending in the Senate, S. 1894. Title II of the Senate bill would require reductions in sulfur dioxide emissions by 12 million tons in the year 2000. However, in 1998, Indiana must commit to either of two options: capping emissions at the level necessary to achieve the State's share of the 12 million ton reduction or imposing a 0.9 sulfur dioxide emission per million Btu's on a monthly average when plants reach 30 years of age. Beginning in the year 2003, all plants must meet New Source Performance Standards when they reach 40 years of age. The bill directs the EPA to revise the NSPS standard, but it is expected to be at least as stringent as the 0.9 standard, if not more so.

This legislation forces the State and utilities to make decisions on reductions before the results of the clean coal technology program are completed. It will lead to the premature retirement of facilities, which is likely to accelerate the need for new generating replacement power, further increasing the costs of compliance. It makes little provision for economic growth.

S. 1894, as a whole, would essentially federalize the clean air programs and make the States administrators of Federal mandates. As such, the Act loses its flexibility to rationally deal with specific clean air problems in particular areas. The bill, in its entirely, would cost the private sector from $15 to $30 billion annually. This does not include administrative costs to the Federal, State, and local governments. I agree with the Administrator of the EPA that the compliance costs of this legislation "are out of proportion to the benefits to be achieved."

Mr. Chairman, I appreciate this opportunity to share my views with this subcommittee. I am certain the testimony presented today by my fellow Hoosiers will be beneficial to the subcommittee's proceedings on the acid rain issue.

Mr. SHARP. I might indicate to our audience that we will welcome any other statements that individuals or organizations wish to submit. They will be available to members of the subcommittee and will be a printed part of the record of this proceeding which will be a part of a larger set of hearings that we are conducting in Washington.

So we welcome all of those comments and statements. And given our limited time—we try to have a variety of witnesses to represent a variety of points of view—I want to ask our colleague from the State of Washington if he has any comments he wishes to make.

Mr. SWIFT. Thank you very much. I am delighted to be here in Indiana. This is my first time. And you turned on good weather, and it is a lovely city and I am very pleased to be here.

Mr. SHARP. We need another kind of rain, however. We need any kind of rain we can get.

Mr. SWIFT. Well, that is too bad. I come from Western Washington and anybody who was ever stationed at Fort Lewis or anything like that thinks that it is raining all the time. And we have a drought out there, too. So we have some sense of what you are going through.

I am a supporter of acid rain legislation who has never signed onto an acid rain bill. And the reason I have not is I have never found a funding mechanism for it that I thought was fair to the industrial Midwest.

I think acid rain is a national problem and I think that there ought to be some kind of cost spread so that the industrial users, the utilities, the individual consumers and for that matter, the coal industries—both our high sulfur and low sulfur coal industries—are not expected to shoulder the entire economic burden of doing something about acid rain.

Those two positions of mine put me in a dilemma. Because the Midwest, largely because it has some very good Members of Congress in some very key positions, has pretty much been able—and I am told they do not like the word, but I think it is accurate—have been able to stonewall acid rain legislation rather effectively.

There is not the remotest question I think in anyone's mind that if acid rain legislation gets to the Floor of the House it will pass and will pass overwhelmingly. So the legislative process has been to keep it from ever getting out of committee.

That puts some of us who have in fact been allies of the Midwest, allies in the sense that we want to see that you are treated fairly on the economic side of this issue, in a difficult position.

If the choices that I have and I think a lot of my colleagues have are between no acid rain legislation at all and something that is not as good a bill as we would like, we will go with the bill that we have.

In short, what I am saying is, it is my sense that it is the view of an increasing majority in the Congress that we have to get on with this.

And I know the frustration—I was talking with a member from West Virginia just the other day—incredible frustration—that people want to move before a lot of people in this region think it is appropriate to move. But there is a rhythm to Congress. And what it is saying is that the time has come to move, whether it is this year or next year or the next year, I do not know. But I would suspect we will not get out of the 101st Congress, the next Congress, without acid rain legislation on the books.

What is more important is that as that political momentum builds in the Congress, the ability of a committee to hold it inside gets less and less and less.

You have things like the continuing resolution. You have things like the reconciliation bill that will come at the end of the Congress—big, catchall bills, in which things can be stuck. And remember I said, if it ever gets to the Floor, it is going to go.

You also have the situation that clean air itself, on the non-attainment side, has got some sanctions that are going to be coming down and we are going to have to do something this year, either, at the minimum, extend those sanctions, extend the deadline into the next Congress, or pass some new clean air legislation.

In other words, what I am saying is, the chances of their being an opportunity to bring acid rain legislation to the Floor of the House this year, is considerable and should be something that is of great concern to you.

The question, and this is the terrible dilemma in which I think the Midwest finds itself, we know what you are against, those of us from other regions and those of us that are concerned with your costs, we know what you are against. What are you for? What can you live with? What kind of cost spread?

There is a large number of us in the Congress I think that want to be supportive and helpful to the people in the Midwest, because, very frankly, if we tear your economy apart it is going to have a ripple effect all across this country. We cannot insulate the Pacific Northwest from a devastating economic hit in the Midwest. So it is in the self interest of everybody to be very sensitive of this. But we have to know what you are for, because the issue may well come up.

One last thing, just to keep you awake tonight. I am getting the sense that there are some of the Members of Congress who are very strongly supportive of the environmental movement who would rather not do it this year.

Think about that. Why would they not want to do it this year?

So the question you might have maybe is, is it smart for us to try and support some rational kind of acid rain legislation with a proper cost spread this year? Those are political judgments. The mood of the House, whether things are going to be worse or better for you in the next Congress, those kinds of issues you have to wade through. But I do believe that the traditional position that the Midwest has held for the last decade of saying let us wait for more clean coal technology—there was a Republican member from New York within the last month who wanted to pull all the money out for clean coal technology until we got acid rain legislation. I do not know whether that was reported here in the Midwest.

Due to some good work on the part of some of your folks from here, that amendment did not get offered. But the frustration level in the East is growing. And so you have to make some judgments as to what you think your best interests are. But I do remember that standing in a schoolhouse door did not really get George Wallace very much in the end. And you might want to think about that tonight, when you are lying awake, too.

Mr. Sharp. Thank you, Al. I seriously appreciate that Al Swift has been one of the members of our committee that has been very open to the concerns many of us have expressed about potential costs on this issue and I think brings us a very serious message that needs to be heeded, that we in the Midwest, if we bury our heads in the sand, will find that we are not a part of any decision that gets made and if we are not part of the decision that gets made, the chances of us paying a greater portion of the bill goes up in my judgment instead of going down and so I think it behooves us to be open and aware and sensitive to the very strong concerns that we are hearing.

The gentleman from New Mexico, Mr. Richardson.

Mr. Richardson. Thank you very much, Mr. Chairman. I think Al Swift has given an excellent summary of the political flavor that surrounds this bill.

Most of us, when we come to Congress—and I might say first, I have been on this subcommittee for three terms, the three terms that I have been here—and I want to just say something about the chairman. And not because we are here in Indiana. But I have found him to be a man of unique ability and fairness and compassion, especially on issues where we have disagreed. And we have on some energy issues.

I come from the Southwest. We have constant needs for energy. We have needs for energy deregulation. And sometimes we differ.

But every time that we have had a matter before Phil Sharp, he has been fair, he has been tough, he has been honest and it is a pleasure to work with him as a colleague.

The second point—my expertise on acid rain probably is—undoubtedly is much less than any of my colleagues here. I was not a member of the gang of nine or group of nine. I have not been a member of the bipartisan compromise. Two years ago when the Waxman bill was introduced in the second session of Congress, I was a cosponsor, because I have a strong environmental record in the West, in the Southwest. We have had problems with forests, with some of our wildlife. The problems have emanated from copper smelters coming out of Mexico. So it is a different kind of problem.

However, in looking at the bill that I had cosponsored, I saw some potential inequities. And those inequities were on certain regions of the country that perhaps, if the figures were right, the 21.9 percent increase or whatever, was an undue share on an individual, all of a sudden, their electric bills, by the year 1997, going that high up.

And as Al Swift said, I think this is a national problem that we all have to share.

I do think that we have to bite the bullet. We have the studies coming out everywhere. And I think the time has come for the political leaders in this country and the political leaders in this State to recognize that we have a problem. Now, how much of an emergency it is, how far we need to go on a short term basis, I think that probably is still open, as the chairman said, to some scientific dispute.

But in the meantime, I think the time has come to really conclude these hearings, proceed with what we are doing now, and if it means waiting until next year to have another extension, so be it.

But I think the American people demand that something be done equitably. We have foreign policy problems, too. We have a summit going on in Canada. And I think our Canadian friends, in the United States, this has become a serious foreign policy problem.

So, Mr. Chairman, Dan Coats, another valued friend on the Commerce Committee who I think is known for his fairness, and Al Swift who has played a key role in trying to achieve this compromise, an extremely difficult task, I salute you and I look forward to spending the day in Indiana. I might say do not worry about your water problem. Your problem here in Indiana is a temporary one. My problem in New Mexico is a permanent one.

Mr. Chairman, thank you for inviting me to your hearing.

Mr. SHARP. Thank you very much. Normally we pride ourselves on our water resources. And our difficulty is right now we need them more than ever.

We are very pleased to have with us a group of witnesses. We are going to take you in several different panels. And I think our folks understand the general rules. We will make a part of our written record any written materials that our witnesses have as well as other folks who wish to submit them. And we would like to have an oral summary at this point and then we will have some questions after our panel has spoken.

We are very pleased to have with us today the Honorable John Mutz, Lieutenant Governor, to represent the State of Indiana.

John, we are happy to hear from you at this time.

## STATEMENTS OF JOHN M. MUTZ, LIEUTENANT GOVERNOR, STATE OF INDIANA; JAMES RYBARCZYK, ASSOCIATE PROFESSOR OF CHEMISTRY, BALL STATE UNIVERSITY; ROBERT W. HILL, CHAIRMAN, INDIANA ELECTRIC ASSOCIATION; AND TIM MALONEY, CHAIRMAN, HOOSIER CHAPTER, SIERRA CLUB

Mr. MUTZ. Congressman Sharp, thank you very much. And I want to say to you and your colleagues that we are pleased you came here to Indianapolis and to Indiana. It is my understanding this is the only hearing that you are holding outside of Washington, D.C. on this subject and we very much appreciate, Phil, your willingness to come here and to allow this rather large group of people who obviously are concerned or have an interest about the question that is involved.

This issue is an emotional issue in the minds of some individuals in this State and in those States that have proposed and who seek the kind of legislation that is involved. And I don't think there is anyone who disputes the right of people in this country to live in a clean environment. I know I certainly do not dispute that and would not be here if I did not have a definite interest in that question.

Clean air is obviously one of the components of a healthy environment and it is one that, as public policymakers, whether we are at the State level or at the Federal level, we need to pursue.

However, it is impossible for me not to appear here today and still do the thing that I am required to do as an official of the State of Indiana. And that is in fact to represent the people of this State, not only in my capacity as the Director of the Indiana Department of Commerce and the Director of Employment and Training Services but also as an official who has a tremendous interest in the kind of impacts that may result from the proposed legislation that you have before you at the present time.

I do ask the chairman to submit our total piece of written presentation, recognizing we have about 4 or 5 minutes here to summarize, and I will do my best to do that hoping to set up an opportunity for discussion and dialogue.

Here in Indiana, in spite of the fact that a commerce official is likely to have a little different viewpoint than is an environmental official in our State, we have put together a task force of officials from four Indiana departments to study in depth the legislation you have before you—the Department of Commerce being one of those, the Department of Environmental Management being the second, the Utility Consumer Counselor's Office the third and the Indiana Utility Regulatory Commission the fourth. And in detail, this task force has been asked to, as professionally as possible, analyze the pieces of legislation—H.R. 2666 and S. 1894.

Now, those bills, as written and as they stand before you at this time, this is basically what they show as far as Indiana is concerned.

Acid rain control legislation provides an enormous—and I emphasize the word enormous—economic burden on every Indiana citizen who uses electricity.

And I might add to that, or what purchases made in factories and mills which use electricity in our State. And they are many and varied.

Now, our analysis was designed to take a separate look at utility rate payers, both residential as well as industrial, to look at the impact on our coal industry which is extremely important, particularly in Southwestern Indiana in some 35 Indiana counties where it is a key component of that economy, and to take a careful look at the impact on those particular segments of our economy and then to look at the overall impact on Indiana's economy.

I would point out to you that Indiana, in spite of our coal industry, is still a large importer of energy. We spend some $7 billion a year in importation of energy, primarily petroleum resources, but nevertheless, low sulfur coal is now a big component. Almost half of our coal consumption coming from outside the State of Indiana due to the existing efforts to participate in the Clean Air Act of 1970.

Now, our concern with this bill is this primarily. The bill imposes schedules in the near future that limit, we believe, the compliance options that public policymakers have wanted to be on the table. Those compliance options consist one, of—I am not sure the schedule in at least one of these bills would allow even the placement of the scrubbers necessary to meet the 1990 requirements.

Number two, there is certainly not enough time nor likely to be incentives for us to take advantage of the clean coal technologies that have been funded by the Congress and that have been encouraged by the Congress.

And four, this is a period of time when suddenly the energy crisis does not seem to be a crisis right now, in the minds of most people. However, I was a part of State government during the time period in which the issue of rationing was real, the question of shortages both in natural gas as well as petroleum products were real and I suspect that as our defendants on foreign imports in those areas continues to grow, that we may once again face some very tough policy decisions at the Federal level and at the State level.

It is for these reasons that I would not want to totally eliminate from our energy mix the midrange and high range sulfur coal which is so plentiful in this part of the United States. This legislation may very well make it, due to the options that it places on the table.

For example, when you say to a utility, do you put scrubbers in or do you buy low sulfur coal, your utility regulatory industry is likely to say well, we want the least cost option, and at least in the short run that is likely to be low sulfur coal and so as a result our coal industry absolutely is eliminated or at least declines so substantially that there is very little left of it.

It is a major energy resource for the State of Indiana and in the United States and I would hate to see it relegated to a position in which it was not part of that energy mix as we approach it.

But I think there are going to be some very challenging days in the future, because the petroleum glut will not be with us forever.

Now, these choices that we are talking about that I think the bill raised, in terms of the utility industry, basically give them the two choices I mentioned—scrubbers, or switch to low sulfur coal.

Compliance costs under our estimate and under our model were estimated to be $2.4 billion in capital in this State for scrubbers and over $205 million annually in increased fuel and other operating expenses.

I would point out that our utilities, some more than others, to be sure, have already taken substantial steps to reduce emissions and those steps are now showing actual progress.

Some of the most recent figures I have seen, in Indiana sulfur dioxide emissions dropped 11.5 percent from 1984 to 1986 and in addition, we project a 25 percent decline between 2980 and 1996, assuming compliance with existing law that is now in place and taking place in the State of Indiana.

So the first issue is its impact on the utility industry.

The second deals with the coal industry itself. The bill's schedule will force additional switches we believe from high sulfur coal, or to high sulfur coal, most of which will come from outside the State of Indiana, that will reduce Indiana's annual production of coal we estimate 3.7 million tons due to fuel switching. This will eliminate immediately more than 900 mining jobs and additional impact on jobs of related industries of some 3,000 jobs.

These impacts are localized as I said in Southwestern Indiana where about 35 percent of our miners are already unemployed. The overall unemployment rate, contrary to the statewide average, which is only 4.8 percent is almost 7.5 percent in that part of the State. If we added those additional 3,000 jobs lost, the unemployment rate would increase to roughly 9 percent.

So we have talked here about the utility industry, the coal industry. Now, finally, the industrial segment of our economy.

As you now, there are limits placed in at least one of these bills that deals with the residential rates, the 10 percent cap, but it does not cap or change industrial rates under the proposal. We believe that the majority of Indiana electricity currently is, at least over half is now generated by locally-mined coal in the State of Indiana, and part of the efficiency of that of course is the coal is nearby, transportation costs are lower and that makes it a very efficient setup in terms of our industrial setup at the present time. And I can tell you that, as the official who is responsible for attracting new industry and new investments by existing companies and by those that are looking at Indiana as a place to create jobs, that our utility rates are an attraction at this particular time. They are making a difference in our ability.

Now, these industries will be forced, we believe, to incur significant electricity cost increases or direct cost increases due to the requirements in the acid rain bills. I guess I can say that this econometric model that we have put together is designed to simulate the impact of electric rate increases, the ones that Congressman Sharp referred to, the same general figures are employed, and what it does basically is give us an indication of what the overall Indiana economy would feel under this situation.

Indiana manufacturers are faced with what we would refer to as a general 3.2 percent increase in production costs which leads to a loss at market of about 5.28 percent of Indiana industrial production. This again is an econometric model designed to study the overall impacts at least, leaving other things constant. Total State employment would decline by 20,200 jobs, under this economic study. State personal income would suffer at least over $400 million per year.

So as I said to you, I am here because Indiana wants to be a part of the solution to a legislative dilemma, as it was described by your colleagues, Congressman Sharp, and yet at the same time I cannot sit back as a State official and not point out the enormous impact that this legislation as proposed would have on the State of Indiana.

It is those kinds of figures that bring me here today. And I must admit, I share some of the difficult choices that must be made locally and at the Federal level. So often in government, it seems that we have principles that we all agreed to individually, pragmatically, to come head to head. And those principles are tough to deal with. And this is one in which we find the principle of employment for everybody who wants a job, who has the ability to hold a job, which I think we all agree is one of our overriding goals, faced with an issue that may—although the scientific evidence is, according to the experts, not totally clear—may have an impact on environmental concerns in other parts of the United States. And so it is that kind of quandary that brings me here with the information and with the commitment that we stand ready to provide you with analysis of any of the proposals that may come before you as time goes along—whether it is Celeste-Cuomo or whatever it happens to be.

Mr. Chairman, thank you very much for a chance to speak.

[The prepared statement of Mr. Mutz follows:]

# STATEMENT OF LT. GOVERNOR JOHN M. MUTZ
# HOUSE OF REPRESENTATIVE'S ENERGY AND POWER SUBCOMMITTEE

JUNE 20, 1988

Mr. Chairman and Members of the Subcommittee:

As Lt. Governor, I am in charge of the economic development program for the state which includes the Department of Commerce and the Energy Division. Our state is enjoying a great deal of economic success. Our employment rate, at 4.8%, is lower than the national average. Over 750 projects have been developed in the state which have created or retained over 132,000 jobs. Indiana has a quality business environment that is an incentive for growth for existing industries and attracts new businesses to our state. State and national policies should assist these efforts, not deter our accomplishments.

The current acid rain bills being considered by Congress threaten our economic successes. Indiana's economy and environment are equally important priorities. These are not mutually exclusive goals. A healthy environment is a goal we all earnestly pursue. It is for this reason that utilities and industries in Indiana and across the United States portion of this continent are investing $30 billion dollars annually to reduce emissions. The effort has been successful. In Indiana alone, sulfur dioxide emissions dropped 11.5% from 1984 to 1986. In addition, a study by the Indiana Coal Council projects that Indiana's sulfur dioxide emissions will decline by 25% from 1980 through 1996. Indiana industries are investing in emission control procedures, including the purchase of scrubbers. The Clean Air Act set guidelines and we are seeing results.

The desire by Congress is to further amend this act and although the intensity of the acid rain problem is still being researched, the current acid rain bills being considered have a devastating effect on Indiana's economy. Four state agencies, the Department of Commerce, Department of Environmental Management, Utility Consumer Counselor's office and the Indiana Utility Regulatory Commission, analyzed the impact of two representative bills, H.R. 2666 and S. 1894, to examine what they would cost Indiana if implemented. The analysis shows that acid rain control legislation would impose an enormous economic burden on utilities, coal miners, industrial employees and utility ratepayers,

Indiana utilities are faced with expensive choices in order to meet the standards addressed in this bill. The bill imposes schedules in the near future that limit compliance options. One of two compliance strategies is feasible: Installation of scrubbers or switching to lower sulfur coal. The analysis predicts capital investments of over $2.4 billion for scrubbers and over $205 million annually in increased fuel and other operating expenses. However, it may already be too late for utilities to install scrubbers and meet the statewide limits imposed by this bill.

The bill's schedule will also most likely force additional switches from high-sulfur local coal to low-sulfur out-of state coal with great impact on coal production in Indiana. At least 3.7 million tons of Indiana coal would be displaced due to fuel switching. This displacement could eliminate more than 900 mining and almost 3,000 related jobs. The impacts are localized in 15 southwestern Indiana counties where 35% of miners are already unemployed and the overall unemployment rate is 7.5%. If the 3,000 job figure is factored in, the unemployment rate would be nearly 9.0%.

The sulfur dioxide control costs, particularly to Indiana utilities, will be substantial. The majority of Indiana electricity is generated by combustion of local high-sulfur coal.

Indiana's efficient coal mining, coupled with it's proximity to local power plants, yields inexpensive electricity. Much of the nation's heavy industry and basic manufacturing is located in Indiana and the Midwest for these reasons. These industries will be forced to incur significant electricity cost increases, or direct cost increases due to the requirements in the acid rain bills. Low utility rates are an economic development advantage for attracting new businesses to our state, but these increases will reduce the effectiveness of that current incentive.

Recently, our analysts used an econometric model of the Indiana economy to simulate the impact of electric rate increases for the industrial sector, to give us a feel for the economic impact of acid rain control legislation. Since H.R. 2666 does not limit the increase in industrial electric rates, we can draw some conclusions about how our state will fare.

Cost increases lead to job losses in related industries. Using only a 14% increase in electric rates, Indiana manufacturers are faced with a 3.2% increase in production costs, which leads to a loss of market for 5.28% of Indiana industrial production. As a result of the reduction in manufacturing, total state employment declines by 20,200 jobs and state personal income is cut by $420.8 million per year. A conservative estimate of jobs lost in Indiana manufacturing industries is 4,820 with total lost shipment value of two-thirds of a billion dollars. Particularly hard hit are Indiana's many metals and machinery industries. For example:

> a central Indiana foundry, which employs 500 workers, would face a 33% increase ($552,600) annually in electricity costs.
>
> A rubber products firm will witness a $351,000 increase annually in electric costs (31%): 750 employees will be effected.

A meat packing plant with 300 employees, will feel a $34,438 increase in electric costs (26%): 750 employees will be affected.

A southern Indiana nursing home will have a $4,095 higher annual electric bill - a 9% increase.

Under the two pieces of legislation being considered in Congress, increases for a majority of Indiana residences, businesses and industries will be over 20%:

Utility Rate Increases

| Utility<br>Territory | H.R.2666<br>% Impact | S.1894<br>% Impact |
|---|---|---|
| PSI | 27.7% | 50.8% |
| IPALCO | 20.4% | 47.7% |
| SIGECO | 14.9% | 48.9% |
| NIPSCO | 7.3% | 26.0% |
| Indiana/Michigan | 6.8% | 23.3% |
| Hoosier Energy | 6.8% | 6.9% |

Although H.R. 2666 has provisions to attempt to provide some limits on how high residential rates can climb, the legality of those methods is questionable under Indiana law. The bill requires that all residential rate increases be substantially equivalent throughout the state as a pre-condition to receipt of subsidy payments. Indiana law dictates that ratepayers cannot pay for utility costs from which they do not receive a direct benefit. To the extent that a ratepayer is required to pay excess amounts to "equalize" the rates of another utility ratepayer, the requirement for such a payment would be unlawful. Also, a ratepayer for a utility that has already taken substantial steps toward compliance (with limits consistent with the bill) would be doubly impacted since his rates already reflect increased costs associated with sulfur dioxide control.

The rate increases predicted by our analysis impact four crucial areas: our existing industrial economy, our efforts to attract new industries and create jobs and most importantly, Indiana residents reliant upon electic power. As you consider the issue, I urge you to consider mechanisms which lessen economic shock, allow for the development of Clean Coal Technology and recognize the importance of midwestern coal reserves to this nation.

I understand that there are alternatives to these acid rain bills being considered. Because these proposals are relatively recent and some are still not finalized, we have not had time to properly analyze their impact on our state. While these proposals are noteworthy, our state will not support solutions that so significantly burden Indiana residents and businesses as in the current proposals.

Hoosiers citizens are concerned with their environment and the environment of others. However, there are no assurances that the controls suggested in this legislation solve the problem. The massive, accelerated, national acid rain research program established and funded by Congress should be given time to finish the job. Resolution of many of the significant scientific uncertainties surrounding the acid rain issue is warranted before Indiana and this nation invest the considerable resources needed to implement acid rain control legislation. It would be irresponsible to impose economic hardships on the people of this region for a control program of uncertain benefit and effectiveness.

I appreciate the opportunity to provide Indiana's perspective on the important piece of legislation in front of your subcommittee. Our recent formation of a new state environmental agency symbolizes our commitment to protecting the environment. Indiana is ready to meet the demands this issue presents, but ask you to weigh the economic and environmental consequences of your actions on our state.

Mr. SHARP. Thank you very much. We have appreciated the analysis already. You have already indicated you will continue the cooperation of various State agencies in helping us to be better informed about direct impacts, and we will need that help as further proposals grow and variations on these proposals will undoubtedly arrive on our doorsteps during the legislative process.

I am going to take you slightly out of order and turn to Dr. Rybarczyk. Dr. Rybarczyk, we are delighted you are here. He had a very serious accident on Saturday and was still very determined to get here, and we respect and appreciate your commitment to trying to help us with the data that you have.

Dr. Rybarczyk is Associate Professor of Analytical Chemistry with Ball State University, certainly an extremely important institution in the Second Congressional District, since I was on the faculty there, and undoubtedly it is difficult to know why Purdue or I.U. would be involved at all. But we are delighted that Ball State is well represented.

But in a personal way, Dr. Rybarczyk, we are very pleased that you are with us this morning and certainly can appreciate if you want to slip away after your testimony. We will leave it to you as to how long you feel you can stay.

I think we are going to have a slide presentation.

## STATEMENT OF JAMES RYBARCZYK

Mr. RYBARCZYK. Thank you, Congressman Sharp and other distinguished Congressmen. I do appreciate the opportunity to be able to speak with you today. And despite the adversity, I felt it was very important to come and share a little bit about what I have been doing for about the last 7, 8 years.

I have been very interested and active in the acid rain controversy since about 1976 and have been working actively in it for the last 7 to 8 years. And I have been working primarily here in the State of Indiana. And one of the philosophies that I followed over this time was based on a quote by one of our other distinguished Senators, Richard Luger, who quoted after the release of the National Academy of sciences Study back in the Autumn of 1983, and I quote this directly:

"At present, scientific evidence does not establish that Midwestern emissions are primarily responsible for the acid rain problems of distant areas. The closer a source of emissions is to an affected area, the greater the benefits that can be achieved from a given reduction in emissions." And what that translates to me is that the closer you are to the source of what these emissions are causing the acidity problem, the more benefits you will see if that problem is cleaned up.

And since Indiana has been targeted as one of the major emitters that is causing problems up in the Northeast and various other areas, by this consequence and this logic it appears that we are receiving a large majority of what we are sending up into the atmosphere that is causing this pollution that we are being targeted for.

We have been targeted as having seven out of the top 50 worst sulfur dioxide emitters. The State has been targeted as being the second largest sulfur dioxide emitter behind Ohio. If we really are the villain that we are portrayed, we should be and we are seeing effects right here in the State.

So a cleanup will involve benefits to our State and the Midwest in general and I think that is very important. It has been something that has been tremendously ignored.

New England has its problems, but I think a large majority of what is happening is occurring right here in the State. What I would like to show you today is some of the work that we have been doing for the last 7 years to show some of the problems in the State of Indiana.

[Slide presentation)

Mr. RYBARCZYK. Now, a lot of these power plants that have been targeted are enlarged 1,000 footers that are being used instead to transmit the pollution long distance, the sulfur dioxide into New England. However a large majority of Indiana power plants such as this one in Crockettesville are between 100 and 200 feet in height. They are not going to be transmitting pollutants long range more than 100 or 200 miles down range. The pollutants from these will not reach New England.

OK. In addition to that, this is the one in Ball State. This one is 149 feet high. We are going to be seeing the impact right in Muncie and in the Delaware County area of Eastern Indiana.

And so we will be seeing the effects of these pollutants if there are any effects, and that is what we tried to study in my particular research.

One of the things we are interested in are structural materials, primarily. One of the major exports of the State of Indiana is limestone and one of the studies we did was to look at the effects of acidity on limestone. We were one of the first groups in the world, actually, not just the Nation, to be studying these types of problems. We presented our work in Washington several years ago and we were the only ones to have any scientific hard data to show some of the effects chemically of how acidity does affect structural materials. And this is just some Indiana limestone that we have exposed to two different pHes to the equivalent for the equivalent of 10-years of rainfall, and you can see the pitting that is occurring in some of these rocks at pH3 and pH4.

This just shows, and again it is just some data that I threw together here on the spur of the moment because of my time limitation. This just shows how some of the material is stripped off of various different materials.

This is the calcium in the limestone that is being stripped off from the top. The one with the sharp spike is coming out of Indiana limestone. The second one is coming out of marble. And the one at the bottom is nitrite, which is a much stronger material. And this shows, this is being stripped at pH3 and it shows how the acidity does affect and decay the various different structural materials.

This is at various different pHes. This is at pH3. This is just Indiana limestone at pH3, pH4 and pH5. The bottom scan is pH5. The middle scan is pH4 and the top scan is pH3 and you can see how much more is stripped off at pH3 than at pH5. The neutral concentration of acidity or the pH of acid rain is 5.6, just as common clean rain. So that is why we use the pH5. And you can see not much is stripped off at pH5. By the time you go down to pH3 a considerable amount of limestone is stripped off.

Now, to show you some examples, this is a classic example in the City of Chicago. This is at the field museum here in the Midwest. And if you ever have the opportunity to go up there you can witness this for yourself. It does not take a Ph.D. to go and look at these. And feel free to do this, because it is a very dramatic example.

This is one of the colonies made out of Georgian marble on the south side of the building. It is an open portico and it is exposed to all of the elements, all of the gases, the dry deposition. The only difference is the inside is shielded from the sun and from the majority of the rain and the outside is exposed to dust. And if you were to look closely at the two edges, the inside edges of the scalloped, raised portions on the inside are fairly sharp and the outside are very corroded and dissolved away.

And I will show you closeups of these.

This is the inside edge. And you can see how sharp it looks. This was constructed in 1921 so it is about 63 years old and it does look like it was just chiseled yesterday. It is very, very smooth, exposed to the same gases as the rest of the colony. The only difference is it was not exposed to the rain.

This is what the outside edge looks like. I went up and measured this very carefully and at various different areas and over one half inch of the material has corroded away in a period of 60 years. So we are talking about structural integrity and structural features of this material. And this is supposedly marble again which is much stronger than limestone.

Based on our calculations that we just did in the laboratory on those other scans that I showed you, we concluded that in the period, based upon the average pH of this part of the country, based upon the material that we used in the limestone, we predicted that .47 inches of the material, or .5 inches, a half inch of material, should have disappeared, and we measured .47 inches. So our laboratory work has concurred tremendously and very surprisingly with what has actually been happening in nature. And we were very, very pleased with this.

Looking closer to home, you can walk out the door and go down the street and look at these yourself. It is currently under a $10 million plus restoration to restore this and they are not going to restore these features. This is on the west face of the memorial and you can go around and look at this. You can barely read that it still says U.S. on the imprinting on there. I have no idea what the rest of it says. And you can look at the damage on the west and the south sides of the monument.

In direct contrast, this is on one of the entrances to the monument and if you look very closely, again, it is exposed to the same gases. The only difference is it is not exposed to the rain. You can still see the chisel marks when this monument was erected at the turn of the century.

And so the only difference is the acidity apparently in the rainfall or the action of the rainfall on this particular memorial. This is Indiana limestone.

A little bit closer to home for me, this is in Muncie Cemetery. And the Federal Government is very concerned about this, and at that conference in Washington we had a lengthy discussion about the Federal grave sites and the grave markers that are being used. This is currently, the current VA ones that are being used are made out of marble and these are of marble and this is in Muncie Cemetery near our industrial district, and this one you cannot see it, being cut off on the bottom.

This was erected in 1978. And you can observe the sharpness of the letters. The VA is currently conducting a massive study on this in Arlington National Cemetery. Again, we were one of the first ones to present data on the letter desk.

This is what one looks like erected in 1978. This is one erected 40 years earlier. And you can see what has happened to the letters, how they have washed away, how they have eroded, how they have broadened.

We went around and measured the letters on various different stones and this is a beautiful chronological dating system. And I want to show one more. This is not marble, this is granite.

And what we are looking at is the letter depths on the left hand scale versus chronology on the bottom scale, which is hardly observable on this. But it just goes from approximately 1900 to 1980. And you notice what happens. Initially the letters gain in depth slightly as they become deeper from the erosion, but then as the face washes away you can see that the material slowly erodes away and the letters will disappear.

There was a very interesting artifact. If you notice both of those plots, one is for the granite, which is technically much, much harder and acid resistant and the other one is the marble which should erode a little bit faster, yet they are both eroding at approximately the same rate.

And the one thing to be noted on both of those scans is approximately in 1937, or between 1935 and 1940, there was a very sharp increase in the amount of erosion that occurs.

For a long period of time we were very, very concerned as to what caused that little glitch in the graph and recently I inferred from oral history in Delaware County that at that time one of the auto manufacturers opened up a sulfuric acid plant very near to the cemetery in Muncie and apparently that is what caused that glitch. Apparently there was so much sulfuric acid in the air that it caused the erosion of the stones. And that is what we have as a conclusion for what caused that particular glitch in there which is quite surprising. So you can see the effect of very concentrated acid on structure materials.

Also I talked to numerous people in the cemetery industry and they claim now that they will no longer accept either marble or limestone grave markers. The only thing that will be accepted is granite because it is the only thing that can withstand most types of erosion.

We have also looked at structural materials of a metallic nature, primarily bronze. This is one of the statues at Ball State University that has recently undergone, as have many statues in Washington and Chicago, major restoration at the expense of $75,000 just to restore this one statue, replate it and coat it with plastic so that it will be impervious to any type of precipitation. That is an expense of $75,000 just for one statue. A significant expense.

We have also looked at the leaching from these materials chemically. The top scan is pH3, the bottom two scans are pH4 and 5. So again the pH3 seems to be a point where a significant amount of material is being leached off of these materials.

We have also been looking at some of our other projects. These are not showing up very well. We are looking at coal and analyzing coal for trace metals and then we are analyzing the acid precipitation found in Indiana and we are trying to correlate what is found in the coal at the source and trying to trace that back as to where the precipitation is falling. We are currently working on this project.

The majority of our project was conducted between the years 1982 and 1985. And through the graciousness of the Central Indiana Rotary Clubs who supplied the volunteer labor we established a sampling station system net work across central Indiana. And these are where all of the sites were located across central Indiana. Not concurrently with the Federal program where only one sampling site is located or two sampling sites located in each State we located up to 30 different sampling sites just across the central belt of Indiana to determine what is the precipitation falling here within the State. And therefore we could document what is occurring across the State. If Indiana is contributing a major amount of acid precipitation we should be seeing effects very close here to home. If we are not causing the problems we should not be seeing this effect across the State.

What the three sets of numbers are on each dot are the 3-year period 1982, 1983 and 1984 and at each individual location and these are the weighted averages of the pHes at each individual location for every precipitation event that year. We are talking about a significant number of data points, approximating 3,500.

And what we have done is, these people have volunteered their labor to go out, sample the rain according to a standard protocol, to go out, collect it, preserve it, collect it for my analysis, and we went in and did all the chemical analyses on these samples.

This was all done with volunteer labor. It was not part of the $100 million studies that the Federal Government was doing. We did this because these people were interested in finding out what was happening within the State and I tip my hat to them, because it was a very difficult effort for them to do.

Anyway, if you look at these you can see that the average across the State is right around the 4.1 region. However, for the second year, the pHes were slightly lower and significantly lower at some stages. This was a drought year, and the 1983–1984 year was a significant drought year within the State and the pHes did drop considerably.

And so what we are talking about in the three regions, very similar to those I used in the studies, and then in the third year of the study the pHes had come back up and they do cycle up and down. We were talking about the standard average base for one annual rainfall, a pH in the very low 4 regions, right around 4.0.

The other thing to be noted by this plot is that if you look across the State there does not seem to be much difference in the pHes for a given year whether you are on the Western border or the Eastern border. And that leads to two conclusions.

If Indiana was such a major polluter, you would expect to see the pH drop as it rose across the State. You would expect to see a much lower pH along the Eastern border as we passed into Ohio, as compared to the Western border. We are not seeing that. The pHes are comparable.

By the same token, if Indiana was not contributing to the problem you would expect to see the pHes go up, the air would become cleaner as it moves across the State. We do not see that, either.

What we are seeing is almost the status quo, that instead of cleaning the air or instead of contributing greatly to the air, what is happening, it seems we are pitching in what I call our share to the problem. We are not making it that much worse, but we are not making it better, either.

So it seems like we are just one link in the chain. We also had, and I do not show this, we had a site way in Western Illinois, in fact further West than St. Louis, where we also sampled. And that one sampling site was consistently from a half to one pH unit higher than these assessments less acidic. It was somewhere between Western Illinois and the Indiana border, acidity was being picked up. We were contributing our share to it as it passed into Ohio, and in turn, Ohio pitched in its share and passed it on further down the range. And this is the proposal that we are seeing based upon our data.

Now, just to give you a frequency of pH, this is just a histogram showing the most likely pHes to fall into. This is part of the 3,500 data points we were talking about. And you can see the most common pHes that fall here in Indiana annually are between about 3.6 and about 4.2.

So we are talking quite a bit of acidity here if the normal average is supposed to be 5.6 for clean air, which is one of the disputed things. But we are still talking pH right around 4 into the high 3 ranges. And there are some up in the 6es and 7s. If you notice also, there are some under 3, which is also significant.

Another thing we have observed which has never been observed before is the seasonal summary. And we can just follow the Indiana chart on the left hand side going from the Fall to the Winter, the pHes in the Fall are right around the 4.1 region and then in the Winter they rise slightly because of the more dust and the snowfall, to 4.3 and in the Spring they come down to 4.2. But look at the Summer. Suddenly the pHes have dropped over a half a pH unit which is a significant amount of acidity increase. Back in the Fall they have risen back up right around 4 and the Winter and so on and the cycle repeats. Every Summer, when the weather becomes hot, for some reason the acidity seems to increase in the air. And we have the Western Illinois data there as a comparison also.

Now, this is that data plotted as a function of temperature and you can see right around the temperature of around 65 to 70 degrees, the acidity drops significantly. There is a plateau where it drops off of from around a pH of 4.1 down to a pH of 3.5. There seems to be something very significant about the 65 to 70 degree temperature range and we are postulating that what is occurring is that the chemical kinetics of the reactions that transform the sulfur dioxides and the nitrogen dioxides into acidity is much enhanced above these temperatures and the acidity that is being pumped into the atmosphere at this point comes down much closer to the home and we are seeing the effects of our home pollution falling closer to home rather than going up to the Northeast. Again, we were one of the first to show this type of correlation.

Now, what becomes more important here, what I have been showing you up to this point have been averages. We will go through these very quickly. I am going to show you some individual rain events, which we have the luxury of doing, which Federal studies do not, because we had so many sampling sites.

This occurred back in 1983 where the wind was coming out of the West Northwest and the front was coming out of the same direction. And you can see that the pHes across the State were fairly uniform from 4.7 at Crawfordsville to 4.1 at Muncie. There does not seem to be much of a change which is one of the most mysterious things we saw when we first saw this study because if Indiana was contributing we were expecting to see a dramatic drop and we did not. It was very uniform. That was the status quo.

This was an interesting case. This occurred in January of 1983 and in this particular case the wind was coming out of the Southeast.

Now, these pHes should have been very high, up in the upper 4 regions. You can see they are not. In this case the wind was blowing out of the Cincinnati area, which is heavily industrialized, a large urban population. And now the pHes are down in the 3 region very much as if in the Summertime. So what it appears to be is very much wind directional oriented, which way the acidity is blowing from. Is it coming out of St. Louis, Southwest area, is it coming out of the Chicago area, is it coming out of the Cincinnati area?

Every rain that was slightly different we took a study right after this, within 2 days, and the pattern was totally different because the wind directions were different.

This is one in April. Once again we are back to the 4 regions. The winds are out of the South-Southwest which is the primary region here and again most of the pHes are in the 4.3, 4.4, 4.5, which is the normal routine.

This is a very interesting one. A low pressure system settled over Ft. Wayne, Indiana and in the Southeast portion of the State, the wind was out of the Southwest. In the Southeast portion the pHes were down in the 3's, in the Southwest they were up in the 4's. So it does appear that there was very much a directionality to this phenomenon.

And now we are into the hot summer months and notice the difference in the pHes. We are no longer up in the 4's. We are consistently down in the 3.4, 3.5, 3.3 range, Crawfordsville, 3.4. And if you look on the left hand side that is a site in far Western Illinois which would be way up the map, that is currently sitting at 5.6 while in Indiana we are sitting at 3.6, a pH difference of 2 which translates to 100 times difference in acidity concentration just passing through the State of Indiana or Illinois into the State of Indiana. That is the difference we are seeing. And this is one of the classic cases. This is again a hot summer month and I will finish with this slide, this is August when the temperature was above 93 and if you will notice, the pHes are down in the low 3s once again. But if you will observe Crawfordsville on the left hand part of the screen, Crawfordsville is 2.8. That is the pH of vinegar. And on that particular day it was raining the acidity equivalent to vinegar here in the State of Indiana—not in New England—here within Indiana at Crawfordsville. And we have seem numerous of those type of pHes both in Muncie, in Crawfordsville and on the East side of Indianapolis.

So this is a real problem here within the State. And I am sorry this was so much of a potpourri, but I did want to present to you some of the data that we have accumulated and I think we have shown there is a problem here in the State. I thank you for this opportunity to present this and I hope this helps.

Mr. SHARP. Thank you very much. We appreciate your testimony.

Let me turn now to Mr. Robert Hill, Chairman and Chief Operating Officer for Indiana Power & Light Company.

## STATEMENT OF ROBERT W. HILL

Mr. HILL. Thank you, Mr. Chairman. I would like to correct that just a moment if I may. I am Chairman of Indiana Electric Association, President and Chief Operating Officer of Indianapolis Power and Light.

Mr. SHARP. Right.

Mr. HILL. I would like to be around for a couple more years.

I would first like to express Indiana Electric Association's appreciation to you and the distinguished members of your committee for allowing us opportunity to present testimony here this morning and since I know that you have a very limited time schedule to hear a lot of testimony I will try to make my remarks brief from the written testimony that we are submitting.

The Indiana Electric Association represents the five investor-owned utility companies of the State of Indiana and as such we serve the electricity needs of some 77 percent of all Indiana Electric customers.

Our purpose in appearing here this morning is to represent the interests of these some 1.8 million customers who are interested in the environment but who nevertheless will ultimately pay the bill for the environmental legislation being considered by your subcommittee.

The Clean Air Act, over the past 18 years, has been an effective public law for protecting the air quality in the State of Indiana and throughout the Nation. But it has come at a high cost. The five investor-owned utilities of the Indiana Electric Association have already invested some $1.5 billion to meet the current environmental laws and regulations.

Since its enactment in 1970, the Indiana sulfur dioxide emissions have been reduced nearly 20 percent. And this has been achieved despite the fact that there has been almost a 60 percent increase in coal used for Indiana electric generation over the same period.

Now, where the Clean Air Act specifically establishes stringent emission standards for new electric generating plants, the proposed legislation you are currently considering would ask the utilities to apply new environmental standards to generating plants which were designed decades ago.

There are three basic compliance choices which we would have to deal with this. One would be to consider scrubbers on units that are operating on a regular and consistent basis and where there is no unreasonable site limitations to their installation. These scrubber systems, as you know, are extremely expensive. And they are expensive to build and they are expensive to operate.

The second alternative which we would have to consider would be the switch to lower sulfur coal from outside the State of Indiana. Now, this would dramatically increase the fuel costs for those units where that would be done because of the more competition driving the demand for the lower cost fuel plus a great increase in transportation costs because of the much greater distances to transmit that coal to our plants and the long rail and switching that would be required to get it here.

The third solution would be simply one of looking at units that because of existing site and design limitations would not lend themselves to either fuel switching or for scrubber installations. There we would retire the units and replace them with new capacity and installation costs many times the original investment of these units.

To the extent that the proposed legislation allows us flexibility to make these choices, the Indiana Electric Association companies would do as they always do. They would look at each of the units and make the most reliable low cost choice for the consumers they possibly could. But it is expensive. Extremely expensive. And as Lieutenant Governor Mutz said, the five companies have estimated an average increase of 15 to 20 percent or more on the electric bills of their customers.

This means conservatively that it would translate into an additional $500 million annually for the electric bills of Indiana consumers. This by the way is on top of the already $267 million a year they are paying to meet their current environmental compliances.

This additional cost obviously would seriously depress the State's economy. And on an individual consumer level, certainly for senior citizens on fixed incomes and the many low income families of the State, they would be hard hit by this additional rate increase.

There has already been mentioned that there are 10,000 or more jobs would be eliminated, including 1,000 direct coal mining jobs. There are other concerns we have about the legislation as well.

As an example, Representative Cooper specifying that coal contracts may not be broken. This would provide an economic dilemma for the utilities because some plants are simply not economically feasible sites for scrubber systems and therefore we would be forced to choose between buying back coal contracts for coal that we could no longer use, for spending incredible amounts of money to construct scrubbers on plants which by their design or other site limitations are not economically appropriate for such emission control systems.

We are also concerned on the impact on the reliability of the Regional Generating Intertied Systems, of which we are a member.

We all depend greatly upon that strength of that intertie and the reliability of those units to support us in times of emergency needs and when we have unit down for maintenance and overhaul and forced outages.

The Central Area Reliability Council shows that H.R. 2666 for example would necessitate the construction of an additional 12,000 megawatts of new capacity throughout its region, which covers 8 States and 27 utility systems, including the State of Indiana, just to maintain the current power levels reliability of the interconnective system. This is over and above the 6,300 megawatts we are forecasting just to meet new load growth. It would take a capital cost of in excess of $18 billion to do that.

There are other causes of concern. And that is the research current going on in technology in advances in emission control for coal fired generating units. If such legislation were to pass it would force us to divert our limited resources from what we are spending on research and this new technology to one of meeting the compliance regulations of the law.

Based on the most current scientific evidence coming out of the NAPAP interim study which has already spent some $390 million to date, the evidence coming out of that study would show that it is just not necessary to make this kind of cost at this immediate future point in time, this immediate point in time.

We believe it is premature to legislate changes now while research is bringing in new facts to light every day that would provide answers to many questions that would be necessary for a prudent decision.

Our Indiana Electric customers are already funding a substantial investment in clean air and the environment. And it is just wrong to make those customers further fund additional environmental controls which ultimately may not be necessary or prove effective. We are talking about a long term expense, 30 or 40 years. Once cast in the pot, that cost is going to be there even if we find 6 or 7 years down the road that some of the costs were not necessary.

The Indiana Electric Association recommendation is to complete the scientific investigation which is to be completed I think sometime the end of next year, analyze the costs and benefits and at least hopefully help us make a more viable solution before proceeding.

In the interim, we recommend that the research and development of cost effective emission control technologies be continued because they offer our best economic hope to use a source that we badly need to use in this country and particularly in this State.

Mr. Chairman, that completes my testimony this morning. Thank you again for the opportunity to be here.

[The prepared statement of Mr. Hill follows:]

## STATEMENT OF

## ROBERT W. HILL

The Indiana Electric Association represents the five investor-owned electric companies in Indiana. Combined, these companies serve the electricity needs of some 77 percent of all Indiana electric customers and provide generating capacity directly and indirectly for about 90 percent of all Indiana electric customers.

It is on behalf of these more than 1.8 million Indiana electric customers that we welcome the opportunity to present testimony before this Subcommittee. Our purpose in appearing is to represent the interests of the Indiana electric customers who are interested in the environment, but who must ultimately pay the bill for environmental legislation being considered by this Subcommittee, and who desire reliable and reasonably-priced electric energy for daily living and economic opportunity.

### I.

In beginning today's remarks, I'd like to reassure this Subcommittee that the Clean Air Act over the past 18 years has been an effective public law in protecting air quality in Indiana and throughout the nation. But, this protection has come at a high cost. Indiana Electric Association member-companies have invested some $1.5 billion to meet current environmental laws and regulations--the major portion of which has been for air quality related control systems.

Since the Clean Air Act was enacted in 1970, Indiana sulfur dioxide emissions have been reduced nearly 20 percent. This has been achieved despite an almost 60 percent increase in coal used for Indiana electric generation during the same period.

I'm sure you are aware that nationwide, according to the Interim Assessment of the National Acid Precipitation Assessment Program, sulfur dioxide emissions by all electric utilities have decreased almost 27 percent, despite over a 71 percent increase in coal consumption by electric utilities.

### II.

Let me now briefly describe what proposed acid rain legislation will require Indiana electric utilities to accomplish over and above compliance with existing Clean Air Act legislation. I will also give you an estimate of the cost of compliance, as well as discuss the economic impact of proposed legislation on our customers and the State of Indiana.

A. The Clean Air Act specifically establishes stringent emission limits for new electric generating plants. Proposed legislation targets existing generating units which were constructed or in the process of being constructed before August 17, 1971. These older units were designed to be as efficient and economical as possible within specific fuel and site guidelines.

With proposed acid rain legislation, we are being asked to apply new environmental standards to generating plants designed decades ago. As you would suspect, this is an extremely expensive and, in most cases, technically difficult, if not impossible, task to accomplish. Here are three basic compliance choices we would have:

First, scrubbers would be considered for units operating on a regular and consistent basis and where there are no unreasonable site limitations. Current scrubber systems are extremely expensive.

A second alternative is to switch to lower sulfur coal from outside Indiana. This would dramatically increase fuel costs, because of higher demand, more competition for this low sulfur fuel and increased transportation costs. In addition, some units would require plant modifications to burn low sulfur coal.

Third, because of existing site and design limitations, some older generating units would not lend themselves to fuel switching or to scrubber systems. These units would have to be retired and replaced with new generating capacity. New capacity in Indiana is expected to cost $1,500 per kilowatt or more, which is many times the original investment in these existing units.

To the extent that proposed legislation allows electric utilities to choose from these alternatives, Indiana Electric Association member companies will strive to provide our customers with the best, and more economical choice.

B. As I said, it is expensive...extremely expensive. Regrettably, the cost will be paid by Indiana electric customers. Statewide, to react to these proposed requirements, it could cost customers of the five companies an estimated average of 15 to 20 percent, or more, on their electric bills. For Public Service Indiana and Indianapolis Power and Light, which represent almost half of all Indiana customers, the increase is estimated in the 20 to 30 percent range. These increases conservatively translate to an additional $500 million added to the electric bills of Indiana consumers. This is on top of the $267 million now paid annually by our customers for current environmental compliance. The net effect would be almost three times today's environmental control costs.

C. Passing these compliance costs on to households and businesses throughout Indiana would adversely affect individual citizens and seriously depress the State's economy as well.

On an individual consumer level, certainly, our senior citizens on fixed incomes and many lower-income families, would be hard hit by these potential electric rate increases.

The negative statewide impact is detailed in a February 10, 1988, Environmental Management Report, prepared by several Indiana state agencies. It concluded some 10,344 Indiana jobs would be lost, including about 1,000 direct coal mining jobs.

D. There are three other clarifications that need to be made about various parts of proposed legislation.

First: Proposed bills, such as Representative Cooper's, specifying that coal contracts may not be broken, provide an economic dilemma for utilities. Because some plants are simply not economically feasible sites for scrubber systems, utilities would be forced to choose between buying back coal contracts for coal that does not meet emission standards, or spending incredible amounts of money to construct scrubbers on plants, which, by design or site limitations, are not economically appropriate for these emission control systems.

Second: As an industry, we are very concerned that the reliability of the regional generating systems will be jeopardized by legislation requiring switching to low sulfur coal or installation of scrubbers. These requirements would cause Midwest generating units to be affected by a number of conditions, including unit derate, increased internal power use, reduced unit availabilities, or premature retirements. A study by the East Central Area Reliability Council shows that H.R. 2666, for example, would necessitate construction of an additional 12,000 megawatts of new capacity throughout its region, including the State of Indiana, just to maintain the current power supply system reliability. The capital investment costs for replacing this capacity would exceed $18 billion (at $1,500 per kilowatt) and is typically left out of control cost estimates.

Third: There will be a cost in terms of developing new technology and advances in emission control for coal-fired generating units. Industry research and development programs could be seriously impaired if we are forced to spend our limited resources on new, expensive compliance regulations.

## III.

Let us now consider the justification for these costs.

Based on the most current scientific evidence, we believe these costs are not defensible in the immediate future. The some $390 million invested in the National Acid Precipitation Assessment Program since 1982 supports this position. Just a short nine months ago, the

National Acid Precipitation Assessment Program said, in releasing its Interim Assessment, that economic analysis was premature, "in part because few effects of acid rain on agriculture, forests, aquatic life and materials have been demonstrated so far and, where present, have not yet been quantified."

## IV.

We believe that it is simply premature to legislate changes now while research is still bringing new facts to light and providing answers to the many questions necessary for a prudent decision.

Indiana electric customers already are funding a substantial investment in clean air and the environment. A clearer picture of tangible benefits is needed before our customers are forced to further fund additional environmental controls which, ultimately, may prove unnecessary or ineffective.

Statewide, proposed new legislation would contribute to significant loss of industry and jobs and have adverse effects on industrial growth.

It is the Indiana Electric Association's recommendation that we complete the scientific investigation and analyze the cost and benefits of various solutions before proceeding.

In the interim, we recommend that the research and development of cost-effective emission control technologies be continued.

Thank you.

Mr. Sharp. Thank you, Mr. Hill. We now welcome Mr. Tim Maloney, the chairman of the Hoosier Chapter of the Sierra Club. Mr. Maloney, we are happy to see you here.

## STATEMENT OF TIM MALONEY

Mr. Maloney. Thank you, Congressman and Members of the Committee. I am here today representing the over 3,500 members of the Sierra Club in the State of Indiana.

Mr. Sharp. Hold the microphone a little closer.

Mr. Maloney. OK. As I mentioned, I am representing the over 3,500 members of the Sierra Club in Indiana and our over 450,000 members nationwide.

Sierra Club is a member-supported, nonprofit, environmental organization. And on behalf of the Chapter here in Indiana, I certainly appreciate the opportunity to testify today and appreciate the fact that the committee, subcommittee, came to town to hear from the various people involved and concerned about the acid rain issue. I do not think it will surprise anyone that my perspective and our perspective in the Sierra Club is quite different than that of the Lieutenant Governor and the utilities.

Sierra Club supports passage of amendments to the Clean Air Act that would substantially reduce emissions of sulfur dioxide and nitrogen oxide the pollutants that cause acid rain.

The amount of reductions we are talking about is about 12 million tons in annual $SO_2$ reductions and 4 million tons in annual nitrogen oxide reductions.

Control of these acid rain causing pollutants would also result in control of ozone as atmospheric nitrogen oxides are required for formation of ozones. Indiana is not only a producer of acid rain-causing emissions, we are also suffering the adverse impacts.

Indiana, as Dr. Rybarczyk mentioned, is the second largest emitter of sulfur dioxide in the Nation. As a result our State has the highest sulfur dioxide densities in the country and the highest sulfate, which are very fine particles derived from sulfur dioxide, concentrations in the United States.

As Dr. Rybarczyk indicated, our rainfall pH measurements across the State are substantially more acidic than normal rainfall and as a result of this acid deposition and sulfate problem and ozone, our resources, both natural and manmade, are under assault from a number of directions.

The Clean Air Act, while resulting in significant air quality improvements, is not equipped to deal with the problems of acid deposition, sulfates or the worsening ozone problem.

Attainment of the national ambient air quality standards for $SO_2$ is no longer believed adequate to protect the public from the adverse health effects of $SO_2$ gases. When attainment of this standard is achieved by building tall stacks rather than reducing source emissions, acid rain results. And once $SO_2$ is transformed to sulfates, it is no longer regulated by the Clean Air Act.

Besides the threats to public health, the environmental and economic losses from acid rain, ozone and their precursors, are enormous.

Nationally, damages from acid rain are estimated at approximately $7 billion annually. Substantial reductions in acid rain-causing emissions would provide benefits to Indiana worth hundreds of millions of dollars, including greatly lowered health care costs, improved agricultural yields, healthier and more productive forests and lowered maintenance and replacement costs for materials and buildings.

Pollution controls create jobs and profits. A carefully crafted acid rain control program that includes use of control technologies would preserve a market for Indiana coal and create a thriving market for pollution controls such as scrubbers.

Let me speak a little bit about the benefits to Indiana of controlling acid rain.

Dr. Rybarczyk very eloquently described the benefits from reducing damages to materials and buildings. There are a number of other benefits that would accrue to Indiana were we to reduce our acid rain-causing emissions and I think our public policymakers do us a real disservice when the acid rain issue is couched only in terms of the economic impacts of control such as the costs of control technology to utilities or the impacts on jobs, particularly in the coal mining industry. Here are a few of the benefits that we may very well realize from a good acid rain control program.

A 1978 Council on Environmental Quality review indicated that a 20 percent reduction in ambient concentrations of sulfur dioxide and particulates from the years 1970 to 1978 resulted in savings of $17 billion each year in health care costs.

Let us look at the benefits to agriculture. A 50 percent reduction in acid levels would result in increased soybean yields over $140 million, according to one study.

A 1984 Office of Technology Assessment Report estimated that reduction of ozone levels to natural background levels would result in increased corn and soybean yields in Indiana worth a total of $165 million. Nationwide, such an ozone reduction would represent about $2 billion worth of agricultural productivity.

In terms of forest and aquatic ecosystems, control of acid rain and its precursors would greatly benefit forest and aquatic resources. One study estimated that economic losses from degradation of Eastern U.S. forests, lakes and streams from acid deposition to total $2 billion. In response to their concern about these threats, American Forestry Association has called for a major legislative program to reduce emissions of sulfur dioxide, nitrogen oxides and hydrocarbons.

Visibility is another direct benefit we would receive. An EPA study has predicted that a 12 million ton reduction in U.S. sulfur dioxide emissions would result in $4 billion per year in benefits from improved visibility, chiefly in the Midwest.

In terms of wildlife—wildlife is very important in terms of its ecological values and benefits and in terms of its values from tourism, outdoor recreation and as a food source.

Tourism and recreation incomes are clearly threatened by the acidification of lakes and streams in the Northeast, the upper Midwest, and the high country of the West.

Not only fish are affected. Animals that depend on aquatic habitats, their food supplies are at risk. Researchers at the Patuxent

Wildlife Research Center found that the mortality of young black ducks raised on experimentally acidified wetlands may be increased by as much as three times normal rate.

And finally, the benefits to jobs and the economy, what we hear a lot about here in Indiana. I think there is another side to that story.

According to a study by Management Information Services, Incorporated, out of Washington, D.C., environmental protection has grown into a major sales generating, profit making, job creating industry. MISI found that 1985 business investments of $8.5 billion resulted in total U.S. sales of $19 billion, generated business profits of $2.6 billion and provided jobs for 167,000 persons.

That same year, expenditures of $4.2 billion for air pollution control equipment alone produce $10 billion in industry sales, $1.3 billion in corporate profits and 85,000 jobs. MISI estimates that even a small scale program of acid rain abatement will create 115,000 jobs and generate $1.5 billion in corporate profits with many of these benefits going to Midwestern States.

As I indicated earlier, if Indiana gets involved in the battle to pass acid rain legislation, then we can come up with a bill that will protect Indiana coal mining jobs.

Finally, I would like to speak a little bit about electricity rates and the various projections of rate increases. I refer to, I believe, a 1984 or 1985 study on Henry Waxman's H.R. 3400 which is fairly similar to his latest acid rain proposal and his study of projected rate increases to Indiana residential consumers range from about $2 to $8 a month with these costs levelized over time.

While I do not want to denigrate the impact of a $2 and $8 monthly increase, it is certainly not substantial.

And from this same study, I think we need to take all the rate projections and alarming rate increases with a grain of salt. Indianapolis Power and Light was quoted in this Congressional Research survey by Larry Parker on describing projections on rate increases as meaningless. IPL stated, there are too many uncontrollable factors influencing future rates to allow prediction of rates with any degree of confidence.

In closing, I would like to say that we have waited long enough. We have been studying this problem for a long time. The evidence is in that we need to do something about the problem. And I certainly hope that Congress will act this year to assure Indiana citizens their right to clean and healthful air.

Thank you.

[Testimony resumes on p. 278.]

[The prepared statement and attachments of Mr. Hill follow:]

## TESTIMONY OF HOOSIER CHAPTER SIERRA CLUB

My name is Tim Maloney, and I am the chairperson of the Hoosier Chapter Sierra Club. I was assisted in preparing these comments by Jeffrey Foster, the chapter conservation chair, and an environmental research scientist. The Sierra Club, a member-supported non-profit environmental organization, has over 3500 members in Indiana. I appreciate this opportunity to present testimony to the Energy and Power Subcommittee of the U.S. House of Representatives. The impacts, both environmental and economic, of acid rain and air pollution in general represent a continuing challenge facing policy-makers in Congress and the state of Indiana. Unfortunately, this challenge has not diminished despite Indiana's attempts to ignore it.

The Sierra Club supports acid rain controls that would reduce annual sulfur dioxide emissions nationwide by 12 million tons, and nitrogen oxides by 4 million tons annually. The issue of acid rain cannot be taken in isolation--the criteria pollutants that cause acid rain, sulfur and nitrogen oxides, produce other environmental problems--particularly sulfate aerosols and ozone. Acid rain controls will have the added benefit of addressing these problems as well.

Our comments will discuss the environmental impacts of acid deposition, sulfate aerosols, and the precursors to acid rain, sulfur dioxide and nitrogen oxides; and the economic, health, and environmental benefits that will accrue to Indiana from its active participation in an aggressive acid rain control program, which we hope will be part of the Clean Air Act amendments now under consideration in the Energy and Commerce Committee.

Indiana contributes a large percentage of the pollutants that cause acid rain in the Eastern U.S. (Indiana is the second largest emitter of sulfur dioxide in the United States). We have the dubious honor of hosting the second worst polluting power plant in the nation, the Gibson Station plant owned by Public Service Indiana. Also in the top five nationally is the Clifty Creek plant, on the Ohio River near Madison.

In total, Indiana sources emit approximately 1.8 million tons of SO2 every year, a slight decline from the emissions total in 1980. However, from 1970 to 1980, while elsewhere in the country SO2 emissions were declining, Indiana's emissions increased by 7%--this after the passage of the Clean Air Act. As of 1988, significant delay still exists in compliance with the standards set by the Clean Air Act: five Indiana counties are classified as non-attainment with the health-based SO2 standard; five more are unclassified, indicating insufficient data is available in order to designate them attainment, or non-attainment. Seven counties are classified as non-attainment for the ozone standard--two of these are nonattaiment for both SO2 and ozone.

Future significant declines in our state's SO2 emissions are in question. Indiana is now in the process of revising its statewide sulfur dioxide regulations. However, with the notable exception of a substantial emission reduction pending for Gibson Station, most SO2 sources across the state will see their emission limits unchanged or slightly reduced. Without enforcement of the interstate pollution provisions of the Clean Air Act by the EPA, or new federal legislation to reduce acid rain causing emissions, citizens of Indiana will not see a substantial improvement in the unhealthful air quality existing in many areas of the state.

Why do we expect inadequate improvement in air quality? First, while most Indiana counties can demonstrate compliance with the existing National Ambient Air Quality Standard for sulfur dioxide, a growing body of medical literature indicates that this standard is not adequate to protect public health (Jay, 1986). Second, the Clean Air Act regulates ambient SO2, a gas, while sulfates, very fine particles derived from SO2, and recognized as a significant health hazard, are unregulated. Indiana's ambient sulfate concentrations are among the highest in the nation. Third, adequate improvement in Indiana's ozone problems may not occur without additonal reductions in emissions of nitrogen oxides. Ozone, a demonstrated health hazard and the primary component of smog, is created by the combination of nitrogen oxides (precursors of acid rain) and hydrocarbons in the presence of sunlight.

Acid deposition, a byproduct of conventional pollutants, was not anticipated by the Clean Air Act. In light of the serious adverse impacts of sulfates and acid rain, it now seems clear that the Clean Air Act's emphasis on attainment of NAAQS, taken by itself, has given air quality regulators, industry, and citizens, a false sense of achievement. For in many instances, including a number of areas in Indiana, attainment of the SO2 standard was achieved not by instituting emission reductions, but simply by building taller smokestacks to blow the emissions downwind and out of the county where compliance with the standard is measured. Unfortunately, Congress and the Courts allowed this regulatory subversion of the Clean Air Act by the EPA and state air pollution officials.

Now, in exchange for technical compliance with ambient air quality standards, we have excessive atmospheric sulfates that imperil public health, reduce visibility, and when washed out of the sky by rainfall, fog, sleet, or snow, become sulfuric acid.

It is clear to us that simply progressing toward attainment of the NAAQS for SO2 and NOx will not result in acceptable and healthful air quality, nor will it alleviate the serious impacts of acid rain being suffered by Indiana and other regions of the country. Amendment of the Clean Air Act is necessary to address the adverse environmental and health effects resulting from the high levels of sulfur and nitrogen oxide emissions.

The scientific literature is overwhelmingly conclusive on the causes, many of the effects of acid rain, and the necessary remedies (see scientific conclusions summary).

In addition to Indiana's contribution to the acidity of deposition falling on our downwind neighbors, and to the problems of regional haze and ozone, we are suffering serious effects from our own emissions.

Pollutant-free rainfall in equilibrium with atmospheric carbon dioxide has a pH of 5.6. Indiana's rainfall is much more acidic than this. For example, the mean pH at three National Acid Deposition Program (NADP) sampling stations in Indiana during the years 1982-1984 was 4.3. During 1986, the mean pH of rainfall at Butler University, collected using NADP procedures, was also 4.3 (Pribush and Carter 1988). Fogs are more acidic than rain. For example, six fogs sampled in 1986 in Indianapolis had a mean pH of 3.6 and a minimum pH of 2.9 (Muir et al. 1986).

Generally, 90% or more of the acidity in rain and fog is accounted for by sulfuric and nitric acids, with sulfuric usually dominant. In Indiana, sulfuric acid contributes about 2.0 to 2.5 times as much acidity to rainfall, and 1.6 times as much acidity to fog, as nitric acid (Muir, et al. 1986, Pribush and Carter 1988).

The findings of at least one study indicates that our rainfall is becoming more acidic.A Ball State University researcher has conducted a rainfall acidity sampling study and found average summer pH levels in some areas of Indiana of as low as 3.3 to 3.5 (over 100 times more acidic than normal rainfall).

Acid rain causing pollutants are responsible for a number of other air quality problems. Indiana, a national leader in SO2 emissions, quite logically suffers from high densities of ambient SO2: along the Ohio River, the highest in the country. Citizens throughout the state are subject to the greatest concentrations of airborne sulfates in the U.S. In the Ohio River Valley, these sulfate aerosols are responsible for the country's worst visibilty-in some areas less than 10 miles.

The Ohio River Valley is one of Indiana's pollution hot spots-the concentration of power plants and industrial sources along both sides of the river contribute to its unhealthy mixture of air pollutants. A US EPA Federal Register notice identified Floyd, Gibson, Jefferson, and Warrick counties as having existing or potential SO2 standard violations. Dearborn, Gibson, Jefferson, and Warrick counties are currently designated unclassified for the sulfur dioxide standard. In terms of ozone pollution, Clark and Floyd counties are non-attainment areas. Additionally, Harrison and Dearborn counties were named in a May 1988 letter from EPA Region V to Indiana identifying Indiana areas in violation of the ozone air quality standard.

Another hot spot is northwest Indiana, with its plethora of air quality problems. Lake and LaPorte counties are non-attainment for SO2; Porter is unclassified. Lake and Porter counties are also ozone non-attainment areas.

Other problem areas include the Lower Wabash River, including Vigo and Vermillion counties; Wayne County, currently subject to a construction ban on new sources of SO2 because of its nonattainment status; and the metropolitan Indianapolis area. Indiana's largest city is non-attainment for ozone and sulfur dioxide(a redesignation request for SO2 is pending). Additionally, the surrounding counties including Boone, Hamilton, Hancock, Hendricks, Johnson, Morgan, and Shelby were named in the US EPA notice of ozone problem areas.

Following is a brief summary of the adverse impacts of sulfur and nitrogen oxides, sulfates, ozone, and acid deposition, focusing on those effects found in Indiana and the Midwest.

## Health Effects of Acid Rain Precursors

sulfur dioxide SO2 is a powerful lung irritant, which aggravates symptons of heart and lung disease; obstructs breathing, particularly in combination with other pollutants; increases incidents of acute respiratory diseases including coughs and colds, asthma, bronchitis, and emphysema. Current medical literature indicates that serious adverse health effects are being documented from short term exposure to levels of SO2 pollution below the existing ambient air quality standard. Medical experts estimate that approximately 35% of the people in Indianapolis are potentially at risk to the adverse health effects of sulfur dioxide exposure. The American Lung Association, in testimony before the Senate Environment Committee, stated "Sulfur dioxide in the air combined with cold, dry air produces symptons of respiratory illness in as little as two minutes. People who live in areas with high levels of sulfur dioxide and severe cold winter weather--such as the Ohio River Valley--are particularly vulnerable to damage."

nitrogen oxides NO2 is a respiratory irritant that can cause bronchitis and pneumonia, and increase susceptibility to viral infections.

sulfates Extremely fine particles derived from SO2, sulfates can be inhaled deep into the lungs. Sulfate aerosols may consist of sulfates and other particulates, and may be contaminated with toxic chemicals and heavy metals. Based on 1978 emission levels, the Congressional Office of Technology Assessment, predicted that airborne sulfate particulate pollution may be responsible for about 50,000 premature deaths annually.

ozone This gas is a powerful bleach, which irritates the respiratory system, impairs lung functions, and can aggravate chronic heart disease, asthma, bronchitis, and emphysema.

acid rain Scientific studies suggest indirect health effects from acid rain. Increased acidity in drinking water can mobilize heavy metals such as lead, copper, and aluminum in drinking water pipes. These metals are well-known in their adverse impacts on human health.

## Effects of Acid Deposition on Vegetation

Acid deposition can affect vegetation in many ways, altering the morphology, biochemistry, or physiology of plant tissues and increasing or decreasing plant growth. Some of these effects are directly attributable to acidity, some result from other ions present in acid rain, and some may be caused by long-term changes in soil chemistry.

Morphological damage is usually expressed as visible, pale green lesions where leaf tissues in contact with acid water droplets have been destroyed. For most species studied to date, pH below 2.5 are required to cause damage (Evans 1982). In general, herbaceous plants are more susceptible to acid damage (i.e. lesions appear at higher pH's) than are broadleaf shrubs and trees, which in turn are less susceptible than conifers; dicot crops (beans, radish, etc.) are more susceptible than monocot crops (corn, wheat, etc.) (Evans 1982, Jacobson 1984).

Repeated exposures to simulated acid fogs can produce foliar injury in a variety of crop species; the pH threshold for damage varies from 2.8 to less than 2.0 (Musselman and Sterrett 1988, Takemota et al. 1988). Lesions caused by acidic aerosols such as ammonium sulfate have been reported, but at concentrations well above those typically observed in polluted air (Evans 1982).

Nutrient leaching, the removal of elements from plant tissues in contact with acidic solutions, has been repeatedly demonstrated in laboratory experiments using simulated acid rain (e.g., Fairfax and Lepp 1975, Wood and Bormann 1975, Scherbatskoy and Klein 1983) and in studies of ambient rainfall as it passes through vegetation canopies (e.g., Cronan and Reiners 1983). Leaching generally increases as pH decreases, but there are exceptions (Evans 1982).

Physiological changes induced by acidity have also been observed, but the results are conflicting. For example, simulated acid rain either decreases, increases, or has no effect on net photosynthesis of crops and tree seedlings (e.g., Irving and Miller 1980, Jaakola et al. 1980, Neufeld et al. 1985, Taylor et al. 1986, Reich et al. 1986, 1987, Trites and Bidwell 1987).

Reductions in photosynthesis or loss of nutrients due to leaching should eventually reduce plant growth. However, experimental results using simulated acid rain are variable. For example, Lee et al. (1980) found decreased marketable yield of five species, increased yield of six species, and no change in yields of sixteen species. Tree seedling growth is unaffected or increases (e.g., Schier 1986, Taylor et al. 1986, Reich et al. 1987).

Growth responses may be affected by pH, source of acidity, species, cultivar, plant age, soil type, and other environmental factors (Evans 1982, Jacobson 1984, Jacobson et al. 1986). Growth stimulations are generally attributed to the nitrate (NO3) and ammonium (NH4) ions present in acid rain.

Although modest inputs of nitrogen and sulfur in acid deposition may have a fertilizing effect, the accumulation of these elements in soils over the course of many years may lead to unfavorable effects on plant growth and metabolism. The conversion of toxic ammonium to organic form may deplete carbohydrate reserves (Nihlgard 1985, Waring and Schlesinger 1985). Excess nitrogen concentrations in plant tissues may reduce winter hardening in conifers (Friedland et al. 1985) and cause other elements to become growth-limiting (Abrahamsen 1980, Nihlgard 1985).

Long-term acidic deposition may have caused changes in the chemistry of soils, including acidification of soil water, cation leaching, and accumulation of sulfate (refs). Soils most at risk are probably those which are not already acid (i.e., pH greater than 5.0) and of low buffering capacity. Thus, acid forest soils and soils on calcareous bedrock (limestone and dolomite) may be at least risk and soils on sandstone and low-sulfur shales may be at greatest risk.

Except in areas where fog occurs frequently, acute effects of acidic deposition such as visual leaf damage in agricultural crops in Indiana are not likely. Widespread calcareous bedrock and the use of carbonate fertilizers should effectively prevent acidification of agricultural soils.

Effects on forests are more likely. Ridgetop soils in southern Indiana often overlie sandstone and thus have low capacity to buffer acid inputs. The oak-hickory forests on these ridgetops may thus be at risk from the effects of soil acidification. Forest soils generally are less fertile than agricultural soils, so the possibility of nutrient deficiencies arising from long-term nutrient leaching from foliage and soils due to acid rain is increased.

## Effects of Gaseous Pollutants on Vegetation

Sufficient experimental evidence now exists to suggest that the current National Ambient Air Quality Standards (NAAQS) for SO2 (0.14 ppm mean 24-hour concentration primary, 0.50 ppm mean 3-hour concentration secondary) and ozone (0.12 ppm mean hourly concentration primary/secondary) are insufficient to prevent harm to plants. For purposes of discussion, we can calculate the cumulative doses (product of atmospheric concentration x length of exposure) of these gases plants would receive if ambient concentrations were constant at one-fourth the values of the primary standards. Assuming an 8-hour daily exposure period and a 90-day growing season, doses would be 25 and 22 ppm-h, respectively, for SO2 and ozone.

Turning first to ozone, a recent review of the literature by Reich (1987) concluded that reductions in photosynthesis and growth are linearly related to ozone dose in a wide variety of species. The order of sensitivity to a given ozone dose is crops > hardwoods > conifers. Major agricultural species (corn, soybeans, tomatoes, alfalfa, etc.) have significant yield reductions when grown outdoors under long-term ozone fumigations at concentrations less than 0.12 ppm (Heck et al. 1982, Takemoto et al. 1988). For a 22 ppm-h ozone dose with an absolute concentration less than 0.12 ppm, Reich's (1987) model predicts an approximately 25% reduction in crop growth, a 15% reduction in hardwood tree growth, and a 4% reduction in pine growth.

Sulfur dioxide doses less than one ppm-h at concentrations well below 0.14 ppm produce measurable reductions in net photosynthesis of crops, shrubs and trees (e.g., Black and Unsworth 1979, McLaughlin and Taylor 1985, Winner et al. 1982, Kaitanen et al. 1987). At 25 ppm-h yield reductions of about 15% and occur in field-grown soybeans, snap beans, and potatoes (McLaughlin and Taylor 1985).

Insufficient work has occurred with ambient doses of NO2 to determine whether or not plants will be harmed. Short-term exposures to concentrations of 0.20-0.25 ppm reduce net photosynthesis in tomatoes and soybeans (Capron and Mansfield 1976, Sabaratnam et al. 1988). These concentrations are four times the current NAAQS standard of 0.05 ppm. However, the standard is for an annual average and individual days could show much higher concentrations.

* * * *

Representatives of Indiana government and industry, and our legislators, do Hoosiers a great disservice when they discuss the economics of acid rain only in terms of utility costs from control technology, or job losses from coal switching. In fact the economics of pollution are much more diverse. The cost of not controlling acid deposition, i.e. the benefits of control are regularly and irresponsibly absent from the statements of government and industry. The argument that we must accept pollution to preserve jobs is not supported by the facts. It is part of a attitude that leads to economic suicide. To the contrary, environmental protection and economic progress are inseparable--we cannot have long-term sensible economic progress without environmental protection.

A prime example of this axiom is Northwest Indiana--an area that is economically recessed and suffers from substantial environmental degradation. Its problems include a multitude of air pollution impacts; contaminated surface and ground waters; and mismanaged solid and hazardous wastes. Has government saved jobs by allowing this mess to occur? I'm sure the residents would answer with a resounding "no!". Environmental problems contribute to economic loss in two important ways: direct health and resource damages--health impacts result in increased medical costs, and lost wages and productivity--resource impacts include damages to crops, forests, buildings, and materials; also, an area's air quality directly affects the decision of business to locate or remain in that area, in two ways. First, business managers look at the "quality of life" as one of the significant factors affecting their location decision, and air pollution has an obviously negative impact on that quality. Second, areas with air quality problems, especially non-attainment areas, present economic and regulatory uncertainities in terms of new construction or expansion of industry. Experience has clearly shown that the wisest solution to this problem is not relaxing pollution standards, but cleaning up the pollution.

Studies indicate that the total benefits of acid rain controls nationally could exceed $7.5 billion. The following is more specific information on the values received from pollution controls.

To human health: Health care benefits achieved from past pollution controls indicate the potential value of further emission reductions. According to a 1978 Council on Environmental Quality review, a 20 percent reduction in ambient concentrations of sulfur dioxide and particulates from 1970-1978 resulted in savings of $17 billion each year in health care costs.

To agriculture: A 50% reduction in wet acid levels would result in increased soybean yields worth $140 million, according to one study. A 1884 Office of Technology Assessment report estimated that reduction of ozone levels to natural background levels would result in increased corn and soybean yields in Indiana worth a total of $165 million. Nationwide, such an ozone reduction would represent about $2 billion of agricultrual productivity.

To forest and aquatic ecosystems: Control of acid rain and its precursors would greatly benefit forest and aquatic resources. One study estimated the economic losses from degradation of Eastern U.S. forests, lakes and streams from acid depositon to total $2 billion. The American Forestry Association, concerned with the threats to U.S. forests, has called for a major legislative program to reduce emissions of SO2, NOx, and hydrocarbons.

To materials and buildings: Again, acid rain controls would greatly reduce the repair and replacement costs of damaged materials and buildings. Estimates of damages from acid rain, SO2, ozone, and other pollutants range as high as $6 billion dollars annually in 17 Northeastern and Midwestern states alone. A Brookhaven National Laboratory study estimated annual damages to buildings and materials in Indianapolis to be $28.7 million. These damages include the cost of repairs to the recently restored Soldiers and Sailors Monument.

To visibility: An EPA study predicts that a 12 million ton reduction in U.S. SO2 emissions would result in $4 billion per year in benefits from improved visibility, chiefly in the Midwest.

To wildlife: Wildlife in general has great ecological benefit, and in terms of tourism, outdoor recreation, and as a food source, substantial economic value. Tourism and recreation incomes are clearly threatened by the acidification of lakes and streams in the Northeast, in the upper Midwest, and the high country of the West. Not only fish are affected. Animals that depend on aquatic habitats and its food supplies are at risk. Researchers at the Patuxent Wildlife Research Center found that the mortality of young black ducks raised on experimentally acidified wetlands may be increased by as much as three times the normal rate.

To jobs and the economy: According to a study by Management Information Services, Inc., environmental protection has grown into a major sales-generating, profit-making, job-creating industry (Cook, 1986). MISI found that 1985 business investments of $8.5 billion resulted in total U.S. sales of $19 billion, generated business profits of $2.6 billion, and provided jobs for 167,000 persons. That same year, expenditures of $4.2 billion for air pollution control equipment produced $10 billion in industry sales, $1.3 billion in corporate profits, and 85,000 jobs. MISI estimates that even a small-scale program of acid rain abatement will create 115,000 jobs and generate $1.5 billion in corporate profits, with many of these benefits going to Midwestern states.

Acid rain control legislation containing requirements for Best Available Control Technology on existing plants, similar to the current Clean Air Act requirements for new sources, will create a substantial market for scrubber sales and construction, while guaranteeing the future of Indiana's high sulfur coal industry.

* * * *

More important than the cost/benefit comparison in determining whether to implement acid rain controls are the larger environmental issues involved. Even if the direct costs of controls exceed the monetary benefits, the need for and importance of emission reductions would not be lessened. We don't know the exact monetary worth of the concept of quality of life, or the full significance of healthy aquatic and forest ecosystems; however their value to human existence is clearly immeasurable.

When faced with potentially irreversible and substantial environmental impacts from acid rain, caution dictates the need for prompt action to control sulfur dioxide and nitrogen oxide emissions, not further study and inaction. Larry Parker of the Congressional Research Service, commenting on the relation of the acid rain issue to other environmental problems that have been addressed by legislation, stated, "Acid rain is no longer a 'new' issue in terms of policy analysis....While issues are continuously refined and more detailed analysis sought, there are few 'substantive' issues in acid rain policy analysis left to be discovered. The amount of policy and scientific analysis done on acid rain issues is overwhelming...." And the EPA, in its self-critique on its unfinished business, reported thet problems relating to criteria air pollutants, including acid rain, are "well-analyzed and understood" compared with other environeatnal problems.

Some Midwestern political leaders have now recognized the problem, and decided to become part of the solution. Notably, Governor Celeste of Ohio, whose state faces similar impacts of control legislation to Indiana, has collaborated with New York to propose a substantial acid rain control program.

There is no question that significant improvement has been realized in our state's and nation's air quality since the passage of the Clean Air Act in 1970. However, in the subsequent years experience has demonstrated that certain pollution problems have not been addressed by the Clean Air Act or the EPA's regulatory and enforcement programs. With the considerable problems remaining, decisive and prompt congressional action is needed to assure citizens of their right to breathe clean healthful air.

## SCIENTIFIC CONCLUSIONS SUMMARY

A report titled "Is there Scientific Consensus on Acid Rain?" examined six major government studies including three National Academy of Sciences studies, a report of the Office of Technology Assessment, a report of the White House Office of Science and Technology Policy, and EPA's Critical Assessment Review papers. The authors of this report, all well known research scientists, concluded

> "Substantial consensus exists on sources of acid deposition, on certain types of damage caused by deposition, and on likely effects of reducing the emissions responsible for the acidity. Adequate scientific information exists to select emission reduction strategies to reduce acid deposition efficiently."

In 1986 the National Academy of Sciences supplemented their earlier reports on acid rain and stated,

> "... we conclude that in Eastern North America a causal relationship exists between anthropogenic sources of emissions of SO2 and the presence of sulfate aerosol, reduced visibility, and wet depositon of sulfate. Our analysis also indicates there is a cause and effect relationship between SO2 emissions and stream sulfate fluxes", and "Analysis of the Adirondack data indicates that no other acidifying process except acid deposition has been identified to explain the rapid declines in lakewater pH during the past twenty to forty years."

The White House Office of Science and Technology Policy in July 1984, noted,

> "Acid deposition has altered the chemistry and biology of aquatic and terrestrial ecosystems of Eastern North America. The principal agent altering the biospherre acidity is traceable to man-made sulfur dioxide emissions ... the ecological problems that clearly result from man-made emissions are sufficiently well substantiated that additional reductions are required to prevent even more consequential environemntal effects."

In June 1984, the Congressional Office of Technology Assessment stated,

> "Thousands of lakes and tens of thousands of stream miles in the Eastern United States and Canada are vulnerable to the effects of acid deposition (INdata)...acid deposition may be adversely affecting a significant fraction of Eastern United States forests: it, along with such other stresses as ozone and natural factors such as drought, may account for declining forest productivity observed in parts of the East.
>
> Both sulfur oxides and ozone can damage a wide range of man-made materials. Airborne fine particles such as sulfate reduce visibility and have been linked to increased human mortality in regions with elevated levels of air pollution.....sulfur dioxide is the logical focus for a program to control acid deposition in the eastern United States."

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Emission Rates for Major Utilty Sources

| Source name | Permitted emission rate lbs/mmbtu | SO2 Control | County |
|---|---|---|---|
| PSI Gibson Station | | | |
| Units 1-4 | 5.1 (2.7) | no | Gibson |
| Unit 5 | 1.2 | scrubber | |
| PSI Cayuga | 5.83 (4.4) | no | Vermillion |
| PSI Wabash River | 4.04 | no | Vigo |
| PSI Gallagher | 6.0 (4.7) | no | Floyd |
| IKEC Clifty Creek | 7.52 | no | Jefferson |
| IPL Petersburg | | | |
| units 1-2 | 6.0 | no | Pike |
| units 3-4 | 1.2 | scrubber | |
| IPL Stout | | | |
| units 5-7 | 5.3 (3.9-5.3) | no | Marion |
| IPL Perry K | 6.0 (2.1-4.4) | no | Marion |
| IPL Pritchard | 6.0 (2.57-3.04) | no | Morgan |
| NIPSCO Mitchell | 1.2 (1.05) | no | Lake |
| NIPSCO Bailly | 6.0 (4.0) | no | Porter |
| NIPSCO Mich.City | 5.3 (6.0) | no | LaPorte |
| NIPSCO Schaefer | | | |
| units 14-15 | 1.2 | no | Jasper |
| units 17-18 | .62 | scrubber | |
| IMEC Breed | 9.57 | no | Sullivan |
| IMEC Tanners Creek | | | |
| units 1-3 | 1.2 | no | Dearborn |
| unit 4 | 8.3 (5.24) | no | |
| IMEC Rockport | 1.2 | no | Spencer |
| Hoosier Energy Merom | 1.2 | scrubber | Sullivan |
| Hoosier Energy Ratts | 6.0 | no | Pike |
| SIGECO Brown | | | |
| unit 1 | 1.2 | scrubber | Posey |
| unit 2 | .62 | scrubber | |
| SIGECO Culley | 6.0 (4.88) | no | Warrick |
| ALCOA Gen.Corp. | 6.0 (5.11) | no | Warrick |
| Richmond Power | 6.0 | no | Wayne |

Numbers in parentheses represent emission rate changes pending before the Indiana Air Pollution Control Board or the U.S. EPA

EIS/PS EMISSION RANKING REPORT

1925 DATA

PAGE: 2

POLLUTANT: SULFUR DIOXIDE   TOTAL EMISSIONS: 1,789,994 TPY   FILE: JANUARY 31, 1987   STATE: INDIANA

| RANK | STATE | COUNTY | AQCR | PLANT ID | PLANT NAME | # OF POINTS | CUM. TOTAL | TPY | % | CUM % |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15 | 1560 | 077 | 0015 | PUBLIC SERVICE INDIANA GIBSON STATION | 9 | 9 | 304265 | 17.0 | 17.0 |
| 2 | 15 | 2140 | 083 | 0001 | CLIFTY CREEK IKEC HWY 56 MADISON IN 4 | 2 | 11 | 268612 | 15.0 | 32.0 |
| 3 | 15 | 4360 | 077 | 0002 | ALCOA GENERATING CORP | 4 | 15 | 163835 | 9.2 | 41.2 |
| 4 | 15 | 4240 | 084 | 0001 | CAYUGA GEN STA PSI PO IND CAYUGA 47928 | 2 | 17 | 126102 | 7.0 | 48.2 |
| 5 | 15 | 3340 | 077 | 0002 | INDIANAPOLIS P&L CO PETERSBURG 47567 | 4 | 21 | 94175 | 5.3 | 53.5 |
| 6 | 15 | 4020 | 084 | 0001 | I&M ELEC-BREED PLANT BX 190 FAIRBANKS 4 | 1 | 22 | 70365 | 3.9 | 57.4 |
| 7 | 15 | 1000 | 079 | 0002 | INDIANA & MICHIGAN ELECT TANNERS CREEK STA | 4 | 26 | 66952 | 3.7 | 61.1 |
| 8 | 15 | 1360 | 078 | 0004 | PUB SERV CO OF IND GALLAGHER STA N.ALB. | 4 | 30 | 63811 | 3.6 | 64.6 |
| 9 | 15 | 4360 | 077 | 0001 | SI GEE CULLEY STA NEWBURGH 47630 BX 218 | 3 | 33 | 62449 | 3.5 | 68.1 |
| 10 | 15 | 2400 | 082 | 0021 | MICHIGAN CITY-NIPSCO | 4 | 37 | 56866 | 3.2 | 71.3 |
| 11 | 15 | 4260 | 084 | 0021 | P S I WABASH RIVER STA, TERRE HAUTE, IND 4 | 6 | 43 | 54300 | 3.0 | 74.3 |
| 12 | 15 | 2640 | 080 | 0033 | INDPLIS P&L-STOUT STA 3700S HARDING46206 | 17 | 60 | 48632 | 2.7 | 77.1 |
| 13 | 15 | 3420 | 067 | 0002 | BAILLY GENERATING STA RR3 BOX 246 46304 | 3 | 63 | 39176 | 2.2 | 79.2 |
| 14 | 15 | 3340 | 077 | 0001 | HOOSIER ENERGY REC INC FRANK E RATTS GEN STA | 2 | 65 | 38033 | 2.1 | 81.4 |
| 15 | 15 | 3960 | 077 | 0020 | IND & MICH ELEC ROCKPORT STATION | 2 | 67 | 22027 | 1.3 | 82.6 |
| 16 | 15 | 3420 | 067 | 0001 | BETHLEHEM STEEL CORP BURNS HARBOR 46304 | 82 | 149 | 19963 | 1.1 | 83.8 |
| 17 | 15 | 2640 | 080 | 0034 | INDPLIS PWR & L,PERRY-K STA, 336 KY AVE | 9 | 158 | 19515 | 1.1 | 84.9 |
| 18 | 15 | 2360 | 067 | 0003 | AMER OIL CO 2831 INDIANAPOLIS BLVD 46394 | 24 | 182 | 19297 | 1.1 | 85.9 |
| 19 | 15 | 4020 | 084 | 0005 | HOOSIER ENERGY RURAL ELEC COOP MERON STATN 4 | 2 | 184 | 18153 | 1.0 | 87.0 |
| 20 | 15 | 2360 | 067 | 0121 | U.S.STEEL CORP. GARY WORKS PAA 11 | 45 | 229 | 17241 | 1.0 | 87.9 |
| 21 | 15 | 2100 | 084 | 0008 | NIPSCO A.M.SCHAHFER STA RR#1 BOX66 46392 | 6 | 235 | 15794 | .9 | 88.8 |
| 22 | 15 | 2880 | 080 | 0004 | INDPLS P&L CO PRITCHARD | 6 | 241 | 15464 | .9 | 89.7 |
| 23 | 15 | 2360 | 067 | 0317 | INLAND STEEL INDIANA HARBOR WORKS | 89 | 330 | 11260 | .6 | 90.3 |
| 24 | 15 | 2360 | 067 | 0210 | COMMONWEALTH EDISON OF INDIANA 4 | 11 | 341 | 9651 | .5 | 90.8 |
| 25 | 15 | 4440 | 076 | 0009 | RICHMOND POWER & LIGHT CO | 2 | 343 | 9536 | .5 | 91.4 |
| 26 | 15 | 3460 | 077 | 0002 | GENERAL ELECTRIC CO MOUNT VERNON | 20 | 363 | 8319 | .5 | 91.8 |
| 27 | 15 | 2260 | 084 | 0003 | EDWDSPORT STA PSI RR 1 EDWARDSPORT 47528 | 4 | 367 | 7812 | .4 | 92.3 |
| 28 | 15 | 3460 | 077 | 0010 | SIGECO-A B BROWN GEN STAT WEST FRANKLIN | 2 | 369 | 7706 | .4 | 92.7 |
| 29 | 15 | 4360 | 077 | 0007 | ALCOA-WARRICK OPERATION NEWBURGH 47630 | 10 | 379 | 7603 | .4 | 93.1 |
| 30 | 15 | 2360 | 067 | 0120 | U.S.STEEL CORP. GARY WORKS PART 1 | 46 | 425 | 6646 | .4 | 93.5 |
| 31 | 15 | 2360 | 067 | 0316 | INLAND STEEL INDIANA HARBOR WORKS | 71 | 496 | 6150 | .3 | 93.8 |
| 32 | 15 | 2360 | 067 | 0117 | NIPSCO DEAN H MITCHELL STATION GARY IN 4 | 7 | 503 | 5603 | .3 | 94.2 |
| 33 | 15 | 2640 | 080 | 0042 | NATL STARCH & CHEMICAL 1515 DROVER INDY | 98 | 601 | 5375 | .3 | 94.5 |
| 34 | 15 | 4100 | 084 | 0012 | PURDUE UNIVERSITY SOUTH BOILER PLANT | 4 | 605 | 4756 | .3 | 94.7 |
| 35 | 15 | 2800 | 083 | 0005 | IND UNIV/BLOOMINGTON 47401 | 6 | 611 | 4656 | .3 | 95.0 |
| 36 | 15 | 0600 | 084 | 0005 | COPLAY CEMENT,BX 459 LOGANSPORT 4 | 5 | 616 | 4565 | .3 | 95.2 |
| 37 | 15 | 1120 | 077 | 0002 | JASPER MUN ELEC EIS ST JASPER 47546 | 1 | 617 | 3514 | .2 | 95.4 |
| 38 | 15 | 4320 | 084 | 0002 | CONTAINER CORP OF AMERICA 455 W FACTORY ST 4 | 3 | 620 | 3494 | .2 | 95.6 |
| 39 | 15 | 4100 | 084 | 0006 | ELI LILLY LILLY RD LAFAYETTE | 21 | 641 | 3369 | .2 | 95.8 |
| 40 | 15 | 4220 | 077 | 0022 | WHIRLPOOL CORP HWY 41 N | 8 | 649 | 3269 | .2 | 96.0 |
| 41 | 15 | 2640 | 080 | 0051 | ROCK ISLAND REFINING HOBATN INDPLS46206 | 27 | 676 | 2873 | .2 | 96.2 |
| 42 | 15 | 1100 | 076 | 0029 | BERGSOE-BOLIDEN INC | 1 | 677 | 2840 | .2 | 96.3 |
| 43 | 15 | 2640 | 080 | 0079 | QUEMETCO 900 QUEMETCO DR 4 | 3 | 680 | 2661 | .1 | 96.5 |
| 44 | 15 | 3700 | 082 | 0013 | UNIVERSITY OF NOTRE DAME | 5 | 685 | 2627 | .1 | 96.6 |
| 45 | 15 | 4240 | 084 | 0009 | ELI LILLY & CO.- CLINTON LABORATORIES | 13 | 698 | 2412 | .1 | 96.8 |
| 46 | 15 | 2600 | 074 | 0005 | FISHER GUIDE DIV. GMC | 5 | 703 | 2287 | .1 | 96.9 |
| 47 | 15 | 3460 | 077 | 0003 | IND FARM BUREAU COOP | 57 | 760 | 2195 | .1 | 97.0 |
| 48 | 15 | 4360 | 084 | 0022 | WESTON PAPER & MFG. CO. PRAIRIETON RD. 4 | 4 | 764 | 2116 | .1 | 97.1 |
| 49 | 15 | 3020 | 084 | 0003 | CRAWFDSVLLE ELEC PO 428 CRAWFDSVLLE 47933 | 2 | 766 | 1857 | .1 | 97.2 |
| 50 | 15 | 4100 | 084 | 0033 | A. E. STALEY MANUFACTURING CO | 12 | 778 | 1831 | .1 | 97.3 |
| 51 | 15 | 3700 | 082 | 0012 | UNIROYAL INCORPORATED | 67 | 845 | 1789 | .1 | 97.4 |

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EIS/PS EMISSION RANKING REPORT PAGE: 3

POLLUTANT: SULPUR DIOXIDE TOTAL EMISSIONS: 1,789,994 TPY FILE: JANUARY 31, 1987 STATE: INDIANA

| RANK | STATE | COUNTY | AQCR | PLANT ID | PLANT NAME | # OF POINTS | CUM. TOTAL | TPY | % | CUM % |
|---|---|---|---|---|---|---|---|---|---|---|
| 52 | 15 | 2720 | 084 | 0001 | PERU ELEC LEP 301 E CANAL ST 46970 | 3 | 848 | 1703 | .1 | 97.5 |
| 53 | 15 | 0600 | 084 | 0005 | LOGANSPORT ELECTRIC LIGHTEPOWER 4 | 3 | 851 | 1489 | .1 | 97.6 |
| 54 | 15 | 2600 | 076 | 0016 | DELCO REMY PLANT #3 | 24 | 875 | 1472 | .1 | 97.7 |
| 55 | 15 | 2360 | 067 | 0242 | STAUFFER CHEMICAL COMPANY | 3 | 878 | 1344 | .1 | 97.8 |
| 56 | 15 | 1100 | 078 | 0002 | BALL STATE UNIV MUNCIE 47306 | 3 | 881 | 1337 | .1 | 97.8 |
| 57 | 15 | 4200 | 084 | 0010 | INDIANA STATE UNIV. 500 N7TH ST. T.H. IND 4 | 4 | 885 | 1335 | .1 | 97.9 |
| 58 | 15 | 2640 | 080 | 0070 | ALLISON GAS TURBINE DIVISION | 9 | 894 | 1314 | .1 | 98.0 |
| 59 | 15 | 2640 | 080 | 0061 | CITIZENS GAS & COKE 3950E PROSPECT ST | 17 | 911 | 1302 | .1 | 98.1 |
| 60 | 15 | 2600 | 076 | 0006 | INDIANA STATE REFORMATORY PENDLETON | 4 | 915 | 1266 | .1 | 98.1 |
| 61 | 15 | 0020 | 081 | 0005 | CENTRAL SOYA CO INC 1200 N 2ND ST DECATUR 4 | 7 | 922 | 1147 | .1 | 98.2 |
| 62 | 15 | 3400 | 082 | 0004 | WESTVILLE CORRECTIONAL CENTER BOX473 WESTVI | 1 | 923 | 1106 | .1 | 98.3 |
| 63 | 15 | 2600 | 076 | 0003 | DELCO REMY PLANT 31 | 1 | 924 | 1067 | .1 | 98.3 |
| 64 | 15 | 1000 | 079 | 0009 | JOS E SEAGRAM E SONS LAWRENCEBURG | 3 | 927 | 1052 | .1 | 98.4 |
| 65 | 15 | 1850 | 080 | 0003 | INDIANA BOYS SCHOOL, PLAINFIELD 46168 | 4 | 931 | 1039 | .1 | 98.4 |
| 66 | 15 | 2400 | 082 | 0032 | IND STATE PRISON PARK ROW MICH CITY46360 | 4 | 935 | 1032 | .1 | 98.5 |

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO THE ATTENTION OF

5RA-14

2 6 MAY 1988

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JUN 01 1988
IANA DEPARTMENT OF
MENTAL MANA

Honorable Robert D. Orr
Governor of Indiana
State House, Room 206
Indianapolis, Indiana 46204

Dear Governor Orr:

On November 24, 1987, the United States Environmental Protection Agency (USEPA) proposed a new policy on how USEPA and the States should address the failure of many areas to attain the National Ambient Air Quality Standards (NAAQS) for ozone and carbon monoxide, two major contributors to urban air pollution. On May 3, 1988, USEPA released the latest data on the degree to which areas throughout the nation have attained these standards. The data indicate that the Chicago-Gary-Lake County (IL), IL-IN-WI Consolidated Metropolitan Statistical Area (CMSA), the Cincinnati-Hamilton, OH-KY-IN CMSA, the Indianapolis, IN Metropolitan Statistical Area (MSA), and the Louisville, KY-IN MSA have failed to attain the ozone standard, despite the passage of the December 31, 1987, attainment date in the Clean Air Act (the Act). These areas are described in more detail in the enclosure to this letter.

I appreciate the efforts made by Nancy Maloley and her staff at the Department of Environmental Management in addressing these difficult air pollution problems. Nevertheless, the attainment date has passed, and we must still continue to make progress towards attainment. As USEPA's policy explained, persistent violations of the standard provide an adequate basis to call for a revision to the air quality plan.

Therefore, consistent with USEPA's responsibilities and pursuant to Section 110(a)(2)(H) of the Clean Air Act, 42 U.S.C. 7410(a)(2)(H), I am notifying you that your State Implementation Plan (SIP) is substantially inadequate to achieve the ozone National Ambient Air Quality Standard (NAAQS) in these four areas (Indiana Counties of Lake, Porter, Dearborn, Boone, Hamilton, Hancock, Hendricks, Johnson, Marion, Morgan, Shelby, Clark, Floyd, and Harrison), and, therefore, requires revision. As to the Indiana portions of the Chicago and Louisville areas, I recognize that you have already submitted SIP revisions for the areas and that USEPA has not completed rulemaking action on these submittals. Our proposal to disapprove these submittals, however, in combination with the air quality data, suggests that Indiana needs additional planning to attain the standard in these areas. For these areas, then, this letter represents a provisional finding (pending completion of rulemaking on your submittal) that the SIP is substantially inadequate to attain and maintain the standard. While USEPA fully intends to complete rulemaking action on these pending SIPs, Indiana should commence corrective planning for these areas now, rather than later in accordance with this letter.

I request that Indiana respond to this letter in two phases — the first in the near future and the second following USEPA's issuance of a final policy on how States should correct their SIPs. The first phase of the response entails (1) correcting identified deficiencies in the existing SIP, (2) adopting regulations previously required or committed to but never adopted, (3) updating the areas' base year emissions inventories, and (4) committing to and developing a schedule for conducting an ambient sampling program for nonmethane organic compounds during the summer of 1989.

As described below, I am calling on Indiana to initiate the first phase without awaiting the outcome of the current congressional deliberations on potential amendments to the Act, and before USEPA issues its final policy. This phase will be essential to the effectiveness of Indiana's current and future pollution control efforts regardless of any future congressional action or the forthcoming post-1987 policy. Moreover, as discussed in the November proposal, these requirements will be the foundation of USEPA's ultimate policy on how areas that attain these standards should assure continued attainment. Our final policy will trigger the second phase of the response by creating additional requirements for Indiana and other States to complete revisions to the SIPs.

The SIP planning called for here will apply to an area larger than the area to which your Part D SIPs historically have applied. In our November notice, we proposed that, for future ozone and carbon monoxide planning purposes, the air quality planning area be expanded to include the entire MSA or, where applicable, the CMSA. The proposal explained that SIP calls would be issued for this expanded area based on the conclusion that sources (e.g., vehicles) in the entire CMSA or MSA contribute to the formation of ozone and CO and to the area's nonattainment. Consequently, this finding of SIP inadequacy applies to the SIP for the counties in the MSA or CMSA listed in the enclosure. Consistent with this principle and pursuant to the Budget Reconciliation Act of 1987, P.L. 100-202 (December 22, 1987), USEPA is also commencing a parallel rulemaking to expand the area subject to a "nonattainment" designation to encompass these counties.

Within the next 2 weeks, my Air and Radiation Division Director will send a letter to the Indiana State air agency describing in detail the SIP call response. I request that Indiana prepare and submit, within 60 days of receipt of that letter, a work schedule outlining interim and final dates to address the enumerated deficiencies and complete the first phase described above. The State should then complete those activities within a year of submitting the schedule. We plan to assess the adequacy of Indiana's response to this letter in determining future Agency action on these matters, including whether the imposition of the Clean Air Act sanctions is appropriate. Any USEPA action that would result from an inadequate response to this letter, however, will be effective only after notice-and-comment rulemaking.

I trust that USEPA and Indiana will work closely together in the coming months so that together we can make progress toward reducing concentrations of ozone and carbon monoxide to healthful levels. I look forward to this cooperative undertaking.

Sincerely yours,

Valdas V. Adamkus

Valdas V. Adamkus
Regional Administrator

Enclosure

ENCLOSURE

# OZONE SIP CALL AREAS

| Indiana Ozone SIP Call Counties | CMSA/MSA |
|---|---|
| Lake | Part of the Chicago-Gary-Lake County (IL), IL-IN-WI CMSA |
| Porter | Part of the Chicago-Gary-Lake County (IL), IL-IN-WI CMSA |
| Dearborn | Part of the Cincinnati-Hamilton, OH-KY-IN CMSA |
| Boone | Part of the Indianapolis, IN MSA |
| Hamilton | Part of the Indianapolis, IN MSA |
| Hancock | Part of the Indianapolis, IN MSA |
| Hendricks | Part of the Indianapolis, IN MSA |
| Johnson | Part of the Indianapolis, IN MSA |
| Marion | Part of the Indianapolis, IN MSA |
| Morgan | Part of the Indianapolis, IN MSA |
| Shelby | Part of the Indianapolis, IN MSA |
| Clark | Part of the Louisville, KY-IN MSA |
| Floyd | Part of the Louisville, KY-IN MSA |
| Harrison | Part of the Louisville, KY-IN MSA |

NATIONAL AUDUBON SOCIETY ACID RAIN MONITORING NETWORK

| STATION | pH | | | |
|---|---|---|---|---|
| | SEPT | OCT | NOV | DEC |
| BORDON | 4.10 | 4.13 | 4.50 | 4.50 |
| INDIANAPOLIS (A) | 3.55 | 4.54 | 4.30 | 4.40 |
| INDIANAPOLIS (B) | | 4.50 | <4.00 | 4.20 |
| NEW CARLISLE | | | 5.20 | 4.50 |
| EVANSVILLE | | 4.06 | 4.90 | 4.80 |
| MISHAWAKA | 3.93 | <4.00 | <4.00 | 4.40 |
| LA PORTE | | | 5.40 | 5.40 |
| NEW ALBANY | 4.07 | 4.00 | | |
| W. LAYFAYETTE | 3.80 | 4.50 | | |
| MEAN | 3.89 | 4.24 | 4.5 | 4.6 |

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM ANNUAL MEAN 4.40
1 STATION

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AMERICAN FORESTRY ASSOCIATION
WHITE PAPER
Forest Effects of Air Pollution

[1]

## EXECUTIVE SUMMARY

### Overview

Air pollution currently poses a significant threat to the health and productivity of our nation's aquatic and terrestrial forest resources. Although "acid rain" has been at the center of the ongoing Congressional debate over air pollution, current research indicates that this is too narrow a focus. The forest ecosystem is subject to a wide variety of natural and man-induced stresses. Acid deposition, for example, does not occur in isolation, rather it occurs in association with natural forest stresses and other pollutants including toxic metals and the dry deposition of sulfur, nitrogen and ozone gases. The potential synergisms among these pollutants and natural stresses must be addressed if an holistic understanding of the forest ecosystem is to be attained. However, given the scientific evidence available, and the risks associated with forest resource degradation, the American Forestry Association believes that further emissions controls of sulfur dioxide, nitrogen oxides, hydrocarbons, ozone, and if feasible, toxic metals are now warranted to protect the forest ecosystem.

### Effects of Air Pollution on Forest Resources

Acidification of lakes and streams, with resulting biological damage, has been widely acknowledged in the last decade. Convincing scientific evidence links this acidification to emissions of sulfur dioxide and nitrogen oxides. Alteration of water quality through pH shock, toxic aluminum release, and increased mercury residues in aquatic organisms are caused by air pollutant deposition to surface waters. It is estimated that the Eastern United States contains some 17,000 lakes and 117,000 miles of streams in areas considered sensitive to acid deposition. In the Northeast, for example, some Adirondack lakes are the unfortunate "classic" case of lake acidification. Reliable historical evidence indicates that acid deposition has severely damaged populations of brook trout, lake trout, other fish and smaller aquatic organisms in many lakes in the Northeastern United States and Canada and may affect sensitive surface waters in the upper Midwest and certain parts of the Rocky Mountains.

Although there is strong evidence that acid deposition has damaged aquatic resources in the United States, it appears that a wider variety of pollutants has the potential to adversely affect terrestrial forest resources. Ozone has been proven to cause damage and mortality of eastern white pine and damage to white fir, ponderosa pine and others in the mountains of southern California. Acid deposition, pollution-induced nitrogen overfertilization, and aluminum toxicity, in addition to the effects of natural stresses, are possible causal mechanisms for declines of red spruce in the Appalachian Mountains. Air pollution is also a possible cause of injury to forests in several other areas of the United States.

Air pollution, especially sulfur emissions, has also been convincingly linked to visibility impairment from particulate formation and resultant light scattering. The ability to clearly view the panorama of forests and related natural features is an important component of the forest recreational experience. Regional hazy air masses caused by pollution often obscure visibility in several parts of the country during summer months, and thus diminish the quality of recreational experiences for many forest visitors.

### Relevant Risk Factors

In spite of general scientific agreement that acid deposition and air pollution have damaged aquatic resources, the question of terrestrial forest effects of air pollution has been placed in a pivotal position in the emissions control debate. Policy decisions have subsequently been delayed while a search continues for complete understanding and irrefutable scientific explanations of the forest health problem. Faced with an incomplete understanding of the cost and benefits of implementing -- or delaying -- additional pollution controls at this time, attention must be focused on the value of prudence and timeliness in decision making and on the risks inherent in each of these postures.

Congressional passage of additional air pollution emissions controls will likely result in somewhat increased electricity costs to consumers and in the loss of some jobs in regions where high-sulfur coal is mined. The associated risk of a control program is that some of these costs might be unnecessary, as a program designed in later years might achieve the same level of protection at lower cost. Acting now also carries with it the risk that had we waited, we might have been able to more accurately assess the correct targets and levels for emissions controls. It is likely that any significant emissions reduction program would take six to 10 years, if not more, to implement, given the necessary planning, contracting, and construction involved. Delaying controls will therefore extend the time required to reduce deposition. And to the extent that resource damage is occurring that is cumulative and/or irreversible, waiting will allow further resource degradation to accumulate.

**AFA Policy Recommendations**

Given the importance of forest aquatic and terrestrial resources to the health and well-being of the nation, the American Forestry Association believes that the risks and costs associated with further delaying additional pollution controls now seem to outweigh the risks and costs associated with action. AFA therefore recommends that Congress amend the Clean Air Act to significantly strengthen control of sulfur dioxide, nitrogen oxides, hydrocarbons, and, if feasible, toxic metals. The control program should target the nation as a whole, as the terrestrial and aquatic forest resource impacts from air pollution constitute a national threat. The newly-strengthened control program could be implemented in stages to allow for mid-course corrections and minimize the impact on affected industries. AFA further recommends that Congress enact an expanded program of forest research, to more thoroughly address not just acid deposition, but the wider range of air pollution impacts -- including those of gaseous sulfur and nitrogen oxides, ozone, and toxic metals -- found in forests.

Mr. Sharp. Thank you very much. Let me just quickly ask a few questions, and I am sure my colleagues have some.

I want to ask the Lieutenant Governor just one, on the proposition that Indiana already is making, has actually stepped up now its effort to reduce sulfur dioxide. If I understand correctly, the most recent effort of the State implementation plan, there will be another increment—I am not sure I have it accurately or not—but like another 17 percent reduction than was already planned in sulfur emissions. And it is in that vicinity. Am I right?

Mr. Mutz. Yes, that is right. Nancy Maloley, who is responsible for the administration of that department is here today, I believe.

Mr. Sharp. One of the things obviously we will be concerned about in Indiana is that if any legislation moves forward, we certainly want that to count in any system that counts emission reductions. I do not think that is inconsistent frankly with the major advocates on this proposition but I think some people lose sight of the fact that there are scheduled reductions underway and now new scheduled reductions. Perhaps you are not the correct person to ask, but if I understand correctly at least in one major utility they will in fact be switching to a low sulfur coal as a way to do that. This is one of the classic problems we have with this system, from a ratepayer point of view, that is in that particular instance will be a very positive move because it is going the least costly way to get the reduction. However, obviously from a coal mining job proposition it can have a negative impact at least on one segment of the coal mining industry.

Mr. Mutz. Well, taking aside the impact on the coal mining industry which is substantial and important in this State, for example, in Northwest Indiana, where we have substantial capital expenditures made by the existing utility already in place, an activity there in which ratepayers are already paying more proportionally speaking than they are in other parts of Indiana, in that set of circumstances, if this bill is applied to that set of circumstances, and allows an additional 10 percent increase, they get hit twice in that part of Indiana.

And I would suggest to you that the economic recovery of Northwest Indiana which is now coming around very nicely, even our steel industry today is now making money for the first time in some 4½ years, I think it might be set back dramatically unless some solution is found to that particular problem. And I know the legislation as written does not solve that problem.

Mr. Sharp. Of course I think what you are talking about is one of the cost sharing features where you would try to levelize rates within a State and therefore you would have cost subsidy from one utility to another utility.

Mr. Mutz. That is right.

Mr. Sharp. And you have raised a classic problem that the burden will fall unequally among the utilities depending on what State they are in, and therefore on ratepayers.

I must tell you, as I have argued for national cost sharing, I have heard the exact same argument from representatives of other States saying that from their point of view they have already done what needed to be done and whether that is an accurate statement or not they cling to it mightily in terms of when I ask them to say why can not we put a one mil charge on all your electricity to help pay for scrubbers or pay for new technology to clean up this mess. And it is one of the classic and real political conflicts that this unfortunately generates.

Let me if I might turn to Dr. Rybarczyk and just see if I can be a little clearer in understanding how far we can draw conclusions from what you have said.

As I understand, your central thrust has been for several years that we are dropping a lot of acid deposition on ourselves and that is what you have been measuring. I am not sure I followed as closely what you seemed to be saying about what you are discovering in terms of our contribution relative to what people are saying on this issue. Do you understand? Beyond Indiana, our contribution beyond Indiana, obviously you are not measuring it elsewhere but you seem to be drawing some conclusions about what is coming in, blowing into the State and blowing out the State from your study and if you could just reiterate that a little bit.

Mr. Rybarczyk. I believe what we are seeing is that, I have visited New England and I have spoken with a lot of my colleagues in New England and their conception and most people's conception is that Indiana is the major source. The buck stops here, basically. And that was one of the things we were looking for in our study was to try and determine whether we were the primary source or the major source of their problems, not just our own but further on down the line as far as the wind blows.

One of the things we were surprised to see was that it does seem to be cost sharing if you will across the entire belt, that there is not one primary source, there is not one smokestack causing all of this problem. There is not just one State causing the problem. Even though we are a major contributor in many respects, we are not the only one. The problem is starting further West. And there have been very many national studies that have shown this where the pH, with these iso-pH charts where they show the pH starts to drop and it does appear to start somewhere out in Missouri or Western Illinois and progressively as the air masses move across the States, Illinois pitches in its share, lowers the pH, we pitch in our share, lower the pH, and so on and this progresses through Ohio and Pennsylvania up into New England.

So it does not appear that we are the major villain, and we are being targeted as such. And in a way I resent that, being a Hoosier. We are not the primary one, there are other people involved in this and we are just one link in the chain that is the process that is creating this problem.

But by the same token, we are also contributing to our own problems. We are importing some of the problem, we are enhancing it slightly and we are shipping it on, some falling on us, some may be exported out of the State.

Mr. Sharp. One of my concerns is that some of the early legislation drafted in the U.S. Senate focuses strictly on the Midwest and does not recognize the State of New York also contributes to its own problem as to many of the other States to its North, as I understand it, and while the proportions may be different, the solution that they would seek to impose is one in which all of the requirements and all of the costs fall back here in the Midwest and without acknowledging what I think is true, which is to not deny that we are contributing but to also recognize that they contribute to their own problem and it has been politically convenient I think for them to assume that all of it is coming from the Midwest.

Mr. RYBARCZYK. I think that acknowledgement is important because we are currently today even, we have been only focusing on one major source of the acidity problem as the sulfur dioxide. The other major contributor, which may be even more important, are the nitrogen oxides. And these arise from automobile exhausts in large urban areas. And Indianapolis has a problem in that respect also, and we have had problems meeting the Clean Air Act in the city, and data has shown, and I was not able to show that, that we, when we looked at the acidity that we have collected here in Indianapolis and East of Indianapolis, that the majority of the acidity is coming from the nitrogen oxides and not the sulfur dioxides, so that there are other major sources of the acidity, and you were mentioning about New York and Massachusetts, a large majority of their problem is not being transported a long distance, it is a local phenomenon also. And I think they need to acknowledge that just as we need to acknowledge our share. And I think Indiana in a way has been trying to ignore the $SO_2$. We have been doing the ostrich routine, sticking our head in the sand. And if we do not want to look at it, then it does not exist. And I think we all need to stand up and say each of us is making a contribution and let us all do something about it and I think this cost sharing thing is one way of doing it. I think this acknowledgement catharsis, if you will, needs to be done by the entire United States.

Mr. SHARP. Let me recognize my colleague from Indiana, Mr. Coats.

Mr. COATS. Thank you, Mr. Chairman. Mr.—is it Rybarczyk?

Mr. RYBARCZYK. Yes.

Mr. COATS. I want to thank you for your contribution, because I think—although I cannot speak for my colleagues—but I think you have added some new information here to our growing pile of data that we are trying to look at in order to make some intelligent decisions on how to deal with this.

I was particularly intrigued by your statement that Indiana does not have that many tall stacks and therefore we are not really contributing to what has been classified as a long range transfer of these pollutants.

Can you go into that in a little more detail? Do you have that information?

Mr. RYBARCZYK. I do not have that information available to me. At one time I did know the height of the various stacks and where they were located and the amount of sulfur dioxide that was emitted. But it was not out of proportion with other locales. And again I primarily concentrate on the central part of the State and the central part of the State, the majority are smaller utilities that have smaller facilities such as the Crawfordsville site or the Ball State site. Those seem typical at least in the central part of the State. There are several large locations in the Southwestern part of the State and South of Indianapolis. But the majority of them do seem to fall under the 500-foot stack level. And therefore a lot of the effects that we will be seeing will be highly localized, within a few hundred miles maximum.

Mr. Coats. What can you conclude about the impact of acid rain deposition in Northeastern States like New Hampshire, Vermont, Northeastern corridors of New York and so forth, in terms of Indiana contribution? Can you give a ballpark estimate of the extent of our contribution to that?

Mr. Rybarczyk. I would have to say, and again, this would be highly ballpark, it would not be more than double digit percentages, perhaps 10 percent, 20 percent. That is very, very difficult. They have done tracing studies. They have done a tracing study from Cincinnati where they have released acid material into the jet stream and they have traced it all the way up to New England but exactly what Indiana's contribution, it is not going to be 50 or 60 percent. And that is what I was talking about, the villain-type scenario. We are not the primary source. If we are doing 10 percent, I would be tremendously surprised.

Mr. Coats. You would be tremendously surprised if we are contributing 10 percent?

Mr. Rybarczyk. Right. To the acidity that is falling in that area.

Mr. Coats. What about to the Canadian problem?

Mr. Rybarczyk. About the same. Again, you are looking at a high local release location, high local concentrations, and that is being dispersed over thousands upon thousands of miles. In addition to our contribution once again you will have to look at the Illinois contribution, the Missouri contribution, the Ohio contribution, all of these put together, and you are talking about approximately 20 different States contributing to the long distance transport. So again if we take 20 different States, you are talking about a 5 percent contribution. I do not see it being that dramatic.

Mr. Coats. You have a State like Florida, which has a tremendous problem with acidified lakes. Now, obviously long range transport of Indiana pollutants to Florida is pretty unlikely. Yet a lot of this legislation, which proposes all the cost, or most often the cost impact for sulfur dioxide reductions on the Midwest, obviously ignores whatever contributions are being made by the State of Florida.

What do we do about a situation like that?

Mr. Rybarczyk. I still think it is a national problem. As was mentioned earlier by one of the Congressmen, I think every region of the country will suffer if the Midwest is penalized in the long run. I think it is a national problem that everyone needs to consider whether they are going to directly benefit by it. I think they will be indirectly benefitted. Florida has its own problems in why it has acidified lakes. They are creating some of the problem themselves, some of it is a geological phenomenon they are stuck with, much as New England. They do not have the luxury of limestone underlaying it as we have here in Indiana.

If we did not have the limestone here in Indiana, I would venture to guess that we would be seeing dead lakes here in Indiana and fish floating belly up. We are not going to see that here. We are not going to see the big, dramatic effects here that New England sees. And therefore it does not make front page news and therefore it is not as serious here.

And one of the things I was trying to do is to show that there is a serious problem here. But we are not going to see Florida's dead lakes, which arises because of their geologic location and because of the ocean being in close proximity.

Mr. COATS. The major problem that you alluded to in Indiana as a result of our own deposition was the structural effect.

Mr. RYBARCZYK. That was only one. I did not have time to—I also worked with trees here in Indiana. And Lieutenant Governor Mutz did not mention that. But one of the problems being experienced primarily in the Ohio Valley and in other locations is the damage to forestry that we are observing now.

And forestry, in addition to the mining industry being a major industry, forestry is the number four industry here in the State of Indiana. And we are currently doing work on looking at what is causing mortality in Ash Trees. I am working with the Indiana Department of Natural Resources on that.

There are many other effects in addition to the structural. That was just one that I had time to talk about and I could show you some slides on. But I have been working on the structural, I have been working on the agricultural, I have been working on the forestry aspect of it. The health issue is another whole issue. There are many, many effects that are not just structural.

Mr. COATS. I wonder if I could ask the Lieutenant Governor, a great deal of your work as head of the Department of Commerce has been in an attempt to both encourage existing industry to expand here and encourage new industry to locate here and from the results in my area anyway you have done a great job because we have a lot of new plants and expanding plants and a lot of new jobs. What I alluded to in my opening statement was the ability to offer reasonable power rates to industries. I wonder if you can elaborate on that and from your experience tell me how important a factor is that in a company's decision to expand and allocate in Indiana and what contribution that is to the job picture here.

Mr. MUTZ. It happens that in Indiana we are more dependent and will continue to be more dependent on manufacturing for employment than the Nation as a whole. Roughly speaking about 26 percent of our jobs today are in the manufacturing field. And they are holding steady and now increasing.

The number of manufacturing jobs is actually growing this last year by about 21,000. And so what that means is if we are to continue to have that economic mix electric rates will continue to be the most important factor. The legislature here does make some effort to control residential rates but does nothing to industrial rates. The economic recovery that blessed Indiana would be seriously jeopardized by the legislation as proposed. We already have higher rates because of heavy investments by the utilities to provide cleaner air under the existing law.

In the case of the manufacturing industry, it is no secret that we are moving towards where the intelligence and capability and training level of our workers is becoming more important. And along with that a new level of technology that these workers use provides higher productivity which is necessary for us to use to compete in the international market. And so energy costs become more of a factor when those pieces of the economic equation change.

What we have then is a situation in which the steel industry, manufacturing and electronic and machinery category, they vary according to the industry in what is actually done in a given plant.

And I can also say that the new ones being built in Indiana are in fact being built with a very strong dedication to clean air and also other environmental concerns involving the water and so forth so that we are not being met in the new construction with anything that would adversely affect the issues that you have on the table today.

Mr. COATS. Mr Chairman, I know I am pressing my luck here timewise. If I could just ask one quick question of Mr. Hill, maybe just a real brief answer.

One of the proposed solutions to the problem is to advance clean coal technology as quickly as possible. Can you tell me in just a thumbnail sketch here what contributions are being made by Indiana utilities in this effort in the State of Indiana?

Mr. HILL. The Indiana Electric Association companies were a participant just a couple of years ago in a clean coal technology project called a BARA project which was a pilot program that took place in one of our plants down South, in an effort to show a new technology that could clean sulfur dioxide and $NO_x$, stack gas.

Mr. COATS. Did it work?

Mr. HILL. It worked—I have not seen the final report. That is being put together now. But there were removals in excess of 90 percent for sulfur dioxide as I recall and 90 percent for $NO_x$.

Mr. COATS. Is it economically viable?

Mr. HILL. The economics are being analyzed now, Congressman, and I really have not seen them.

Mr. COATS. If it is viable, what time frame are you looking at?

Mr. HILL. That was on a five megawatt pilot plant so that has to go through a demonstration project. You have to get it in terms of at least 100 megawatts to be commercially available.

Mr. COATS. Are we 3 years, 5 years, 10 years, 20 years?

Mr. HILL. I have no guess. But we are not going to see that within the next 3 or 4 years, I am sure of that.

Mr. COATS. Thank you, Mr. Chairman.

Mr. SHARP. The gentleman from Washington, Mr. Swift.

Mr. SWIFT. Thank you, Mr. Chairman. I was going to address a question about the numbers but I think I will just make a comment and go on.

One of the things we find in this committee is that utilities often aggregate costs and they will say, I think your figure, Mr. Hill, was $500 million rate increase. Then when we break that down to what it means to the average residential holder you are talking cents often. And on the other hand, Mr. Maloney, I know there are compensatory benefits. But what we pick up in soybeans and invisibility is not going to compensate very much the guy in Southwest Indiana who lost his job in the coal mine. I mean, those economic compensations do not necessarily get spread to where the economic harm is and so I think you do have to keep in mind exactly what you say. This is not all costs. There are benefits to cleaning up the environment. There is no question about it. But you still I think have to be careful of where the cost comes because often the benefits do not flow to make it a dollar for dollar or anywhere near it compensation to where the harm came.

I would like to ask Dr. Rybarczyk if he could comment a little bit on the difficult problem we deal with constantly, when do we know enough to legislate?

And I am afraid the NAPAP study is used, that if we just wait until the end of NAPAP, then we will know it all. And I have never seen a scientist yet that says we ever get to that point.

On the other hand, we as legislators do not want to legislate out of ignorance. But you can always argue if you would only wait another 2 years you will know more. And so we have to make the decision and you cannot decide that for us. I know that. But could you just comment a little bit on how the development of information can interact with public policy?

Mr. RYBARCZYK. I think that is a very difficult question to answer, and I do not think I can answer it.

When do you know enough? I think as a scientist myself I always like to approach that question. I work in chemistry all the time and make solutions and do chemical reactions. Yet I have never seen an atom. I have no idea what an atom looks like. No one has ever seen an atom. Yet does that mean that chemistry does not exist? OK. When do you have to keep working and keep working and keep working until you have everything definitively known? And I do not know if we will ever achieve that point, much as you are saying. But because I have never seen an atom does not mean I cannot do chemistry.

Well, the same thing here. How long can we keep working at this? If we work long enough, maybe the problem will just go away. We will find a new form of energy perhaps in the ocean, there will be atomic fusion reactions coming on instead of fissions. I myself, if you sit down and look at all of the evidence that has come in and get away from who paid whom to find this set of results and that type of thing and take very much independent studies—one of the reasons the work that we have been doing has been totally unfunded. We did all of this on a thumbnail with volunteer labor trying to keep it free of all of these people picking and pulling much as I am sure you have at you.

If you take the independent evidence and you weight that, I think we have done more than enough.

Again, I have been following this problem since it was announced back in 1976 and it is just been interesting to follow what the responses to acid rain have been. First of all, there is no such thing as acid rain. Then yes, there is acid rain but it is not much of a problem. All of a sudden, yes, there is acid rain, yes, there is a problem, yes, we can do something about it but if you want it done you have to pay for it. And just to watch the evolution that way. I think we have gone far enough at this point. I do not think there is anything more to wait for. We have seen evidence that there is a problem. I think I have shown you data today. You can go out yourself and collect the rain and measure the acidity. It does not take a Ph.D. to do that, and do it well.

Mr. SWIFT. And it is true that the information from NAPAP is coming out as they study it, it is not like they are going to hold it secret until the end of the 10 years and then suddenly give us that information.

Mr. RYBARCZYK. Right. I think the information is there. I think it is going to be your jobs to filter through and get rid of all of the things that have been tainted if you will. A lot of the sensational things about loss of jobs—there does not have to be a loss of coal miners' jobs. We have the technology to use the Indiana coal.

Mr. SWIFT. Well, that is a marvelous lead-in as they used to say in the broadcasting industry that I come from, into what my next question is. Because we have been talking a lot obviously about the bill that is before us. But those are not the only proposals. We have now the Celeste-Cuomo proposal. Jim Cooper, who is a member of the full committee has been working on an acid rain proposal. The so-called Group of Nine is working on something.

So I would like to just ask the other panel members what can you live with? Obviously, some of you would rather have nothing, and some of you would like to have as full a load of pollutant controls as you could get.

But how can we get started on this, begin to make some improvements in acid rain, and not devastate the economy of the Midwest.

It seems to me to be the central question that the committee has to deal with and I am wondering if any of you have any observations you would like to make in that regard.

Mr. Hill?

Mr. HILL. Is this mike working at all?

Mr. SWIFT. Maybe you are better off not being heard up here.

Mr. HILL. Probably so.

The thought crossed my mind, while I was sitting here listening to you, that I remember a few short years ago where our industry, at the discretion of the utility managements, had to make decisions on building new capacity to meet what we thought was going to be future load demands.

And we did that. And because the load did not occur as we thought it would, the industry was beaten down pretty badly and in fact the ratepayers did not have to pay for all those costs because many commissions——

Mr. SWIFT. You are talking about somebody from "WPPS Country."

Mr. HILL. I understand you.

I am just glad that I do not have to sit in your position and make that decision this time, because this time it will be a legislative decision and we will comply with it, whatever those decisions are, and those costs will be paid for by the consuming, voting public. That is a very difficult, complex issue and I think from all the testimony you heard here this morning, we are still talking about making decisions on something we are not all that certain about.

And I do not know. There is no easy answer.

Mr. SWIFT. The Tobacco Institute tells us we have not proven there is any connection between cigarette smoking and cancer, either. They are the only people in the world who believe it.

So we will have to decide when we know enough. I will tell you, most of the House of Representatives today thinks they know enough. Whether they do or not, that is their impression.

And the question is, if we are going to do something, there are a lot of us outside of your region who will be supporters of people from your region to try and do it in a way that will have the smallest possible economic impact on the region.

But we kind of need to know what you are looking for. You do not come full blown to Congress understanding the economics of the Midwest.

And if you are kind of taking the position of George Wallace in the schoolhouse door saying "never," you are not contributing any information to us that will help us try and draw some reasonable lines.

Let me put the shoe on the other foot. Mr. Maloney, I know you would like a perfectly pure environment. But what can you live with?

Mr. Maloney. I think there is definitely room for flexibility. I have lived in Indiana all my life. I know the problems that we face in terms of the coal industry and the electricity rates. We are certainly not insensitive to those concerns. I am a customer of Hoosier Energy who just brought a new power plant on line a couple years ago. And my electricity rates nearly doubled. But frankly, I feel that many people in Indiana and across the country are willing to pay reasonable costs for acid rain controls and for environmental protection. But as I stated earlier, I think there is some flexibility. I am certainly encouraged by the Cuomo-Celeste proposal which holds some promise. I believe it could be improved. But it holds some promise and it is also significant in the fact that you have the Governor of the highest emitter of sulfur dioxide in the country coming out in support of strong acid rain controls.

Mr. Swift. It is also significant I think you have the Governor of a State that claims largely to be the victim of acid rain willing to share in some sense some of the cost, which I think is a real breakthrough in trying to deal with it.

I must say to Mr. Hill, I have an I.O.U. in my district. And I once, at a utilities meeting breakfast, gave a speech in Washington, D.C. that suggested there might need to be some nationwide cost sharing. And I spent a half an hour out in the hall with that CEO telling me he was not going to put a penny into anything that was going to help the utilities in the Midwest.

Mr. Maloney. Must have been Hydro.

Mr. Swift. It was Hydro, absolutely. But my point is, I think one of the most impressive things about the Celeste-Cuomo proposal is the Governor of New York is willing to entertain some costs on his people in order to be able to deal with the problem.

Now, if we can get a broader range of people willing to do that, then we really develop some flexibility in dealing with the economic hit in the Midwest.

And that would be helpful. But I also think that it is my observation that the most rigid environmentalists in the Congress have wanted to be so inflexible on this that we have gone 6 years and have not got any legislation.

Now, they can blame it on the stonewallers. But the fact is there has been no flexibility on the other side either and it really gave those who felt they would be affected adversely by it little opportunity to try and be reasonable and flexible either.

So what I am really saying is if Mr. Hill says we cannot do anything and you say we have to do it all, you just have a head to head and somebody is going to win, but you probably do not come up with the most rational solution that you could and one that can get started on cleaning up acid rain and do so without devastating all the good people here in Indiana and throughout the Midwest.

So I would appreciate if you would both start thinking about what can you live with, what will get us started? Because that is the question we are all going to have to answer.

Mr. Hill.

Mr. Hill. Well, Congressman, in my testimony I said we have been started. We have been started since 1970. It is not as if we have been sitting here doing nothing.

We have been putting scrubbers on new units. We have been selectively purchasing coal. We have been doing things to make our units more efficient and we have made progress in reducing $SO_2$.

The question that I have, it is interesting that the doctor, in his testimony, said the question that has not been answered to me, at least I did not hear the answer, was he suspects that the transportation $NO_x$ may be a serious part of the acid rain issue, too.

Now, to what degree is that a problem in adding to it? And we can go down the line going through $SO_2$ and $NO_x$ in power plants and we may not solve that problem.

Mr. Swift. That is a good question. But the automobile industry tell us, we heard a figure of something like 20 percent had been cleaned up here, stacks—the automobile industry says we cleaned up 96 percent of the pollution coming out of our tailpipes and we should not have to contribute any more.

Now, the modest proposals are saying they are going to have to come up with another percent and a half. And so for you to say we have cleaned up 25 percent of it and so that is good, you know, tell it to Detroit. Because they think they have made an even larger contribution.

I think that we do, in talking about what problem is left to be solved, leave the impression that you people have done nothing. And that is not fair. And I am sorry if I contributed to that.

There has been an enormous effort, under the Clean Air Act, and you have done a good job in that regard. The Clean Air Act does not address all the problems of acid rain, unfortunately. So we may need to do something additional. And I am just searching around for something that is not going to put you out of business or destroy your industrial customers or your agricultural or residential customers, but will get us started into putting less money into restoration of statues.

Thank you very much.

Mr. Sharp. The Congressman from New Mexico. I would remind my colleague from New Mexico that the time is starting to press on us. And I certainly want him to have an opportunity to ask questions. But I suddenly realize that we could spend all morning profitably with this first panel, but we have other witnesses, too.

Mr. Richardson. In that spirit, Mr. Chairman, I will just have two questions.

One is that I notice the divisions here about how we deal with this problem when we deal with it at the Federal level.

And I wanted to ask Mr. Maloney and the Lieutenant Governor, in terms of State legislation and through the State legislature, do you experience the same paralysis that we may be witnessing today at the Federal level? Has there been some substantial progress in terms of State legislation?

And I guess, to Mr. Maloney and to the Lieutenant Governor, I wonder if this task force of yours, if you have had occasion to look at I guess the central side of Mr. Maloney's testimony, that there are jobs created out of benefits of control? Are the decisions so clearcut on say clean coal technology?

I come from a State that produces a lot of clean coal that is low sulfur and I would like to know if the differences in these arguments that we are having here are so clear cut within your own governing bodies.

Governor, maybe you should proceed first.

Mr. MUTZ. Well, I would start by saying that, to be sure, whenever economic dislocation takes place there are compensating factors. We recognize that.

The compensating factors, though, we need to look back to the very beginning. There is an economic theory called the "broken picture window" theory which basically says that if we want to generate lots of jobs for people in the glass industry we would go around the country breaking windows out of people's homes, the net result being we would have to make more glass windows and put all those people to work.

But of course the other option at that point in time is where do you in fact spend those same dollars if you do not have to fix your windows?

And of course you spend them in other parts of the economy, and you spend them for things that largely relate to an increase hopefully in the standard of living or the quality of life of the people that are involved.

So that is at the fundamental bottom of this business of offsetting questions. There are certainly some benefits to be gained to society, some which cannot be quantified, some which can be. And I am the first to recognize that. And I think that is a useful part of our analysis for the future.

Right at this moment I want to say to all of you gentlemen, because you come here with a very sensitive ear I think to us in Indiana. And I appreciate that. A sensitive ear somewhat that I did not really expect today. Because you have noted that the impacts of the bills as currently presented are a disaster for Indiana as they stand presently.

On the other hand, you have said we think there is a time and a place to move in this area. And that is an issue that revolves around scientific evidence, and a number of things that I leave to experts.

But I would suggest that we appreciate your sensitivity in that respect. And I think that I want to go on the record right this moment of saying that a balanced panel, which we have attempted to create, with representation from our environmental people as well as from the Department of Commerce, et cetera, we stand ready to analyze any of the proposals, to give you playback and evidence as to where it cuts in Indiana, not just the coal industry, but the entire Indiana economy. We think that would be a useful part of our participation in this subject.

And I realize when you do these analyses that you can quarrel about the figures. But I think we are now getting pretty close to figures in which the utility industry and regulators and others come pretty close to agreeing on the front end impacts.

Now, the compensating impacts that Mr. Maloney talks about are another issue entirely. We need to do some more work in that respect. I think that is a sensible way to look at this.

Mr. Richardson. Mr. Maloney?

Mr. Mutz. Yes, I would be happy to comment on that.

If you might turn to one of my attachments on my comments, I have a chart of the emission rates for the major utility $SO_2$ forces in Indiana and this will help on a discussion of what the State of Indiana has done about the problem.

And it is true that right now the State is undertaking a revision of our State implementation plan for the sulfur dioxide rules.

I might add that that action was precipitated by a Sierra Club lawsuit to force action on the $SO_2$, since Indiana has not had a federally-enforceable $SO_2$ law for a number of years due to a court case decision.

On this chart, the numbers in the right hand column on the left are the original emission standards for these plants. The numbers in parentheses are pending emission reductions. They are either pending before the Indiana Air Pollution Control Board or the EPA and in some cases you do see reductions. Notably, the Gibson station operated by Public Service Indiana. The Gibson station, by the way, is the largest emitter in the State of Indiana and I believe the second largest in the United States.

You see on the other hand the Clifty Creek plant down by Madison, Indiana, the second largest emitter in Indiana, has a very substantial emission rate and that emission standard was reapproved by the State within the last several months.

And Clifty Creek does not sell any retail electricity in the State of Indiana so the cost of the control technology on that plant would really have negligible impact on the State of Indiana.

And that plant also purchases a great deal of Indiana coal. And you would certainly be guaranteeing a substantial market for Indiana coal.

If we move down to the Indiana and Michigan Rockport Plant which is a brand new plant on the Ohio River also, I believe in the range of 1,300 megawatts, that plant burns totally Western coal and managed to make it through its permit process without the requirement of control technology.

My work has estimated that if that plant could burn Indiana coal they could burn close to one third the annual production of Indiana's coal fields.

Mr. Sharp. If they put scrubbers on?

Mr. Maloney. Yes. If they were to install scrubbers, they would be able to burn Indiana coal.

These are just a sampling of the Indiana plants and you can see the ranges of changes in the emission rates. A number of the largest plants in the State, such as Clifty Creek, the Bree Plant, the Tanner's Creek plant, will continue with substantial emission rates, into the future. And these are plants to a large extent that are fairly new plants that are going to be around for a long time. And without control technology they are going to continue to emit a substantial amount of sulfur dioxide pollution.

And we can gain a dual benefit by working on a control plan that requires control technology, both in reducing the emissions and protecting the Indiana coal jobs.

Mr. **Richardson**. Thank you, Mr. Maloney. Thank you, Mr Chairman. I know you are anxious to move on.

Mr. **Sharp**. I am sorry, because I think we could and I think all of us have additional things we would like to pursue with this panel but we want to get a broad range of witnesses before us today.

I want to thank all of you for your preparation and your time and attendance here, and your help to the subcommittee, and we are hoping to call on you in the future, and we will certainly expect to. And thank you very much for being with us.

Ladies and gentlemen, I think you are aware that your statements will be included as a part of our record, and any other materials you wish to provide.

Mr. **Sharp**. And we are delighted to hear your oral summary at this time.

Mr. Gresham, who is Vice President of Law and Government Affairs for the AMAX Coal Company, representing the Indiana Coal Council, will begin at this time.

If we could have a little more order in the room so everyone can hear, I would appreciate the cooperation of our audience.

Mr. Gresham.

## STATEMENTS OF WAYNE E. GRESHAM, VICE PRESIDENT, AMAX COAL CO., ON BEHALF OF INDIANA COAL COUNCIL; DARRELL V. MENSCER, PRESIDENT, PUBLIC SERVICE COMPANY OF INDIANA; LARRY REYNOLDS, PRESIDENT, DISTRICT 11, UNITED MINE WORKERS; AND CHARLOTTE REED, EXECUTIVE DIRECTOR, SAVE THE DUNES COUNCIL

Mr. **Gresham**. Good morning, Mr. Chairman, members of the committee, Representative Coats.

We welcome you to Indianapolis, and we are delighted that you came to the heart of the Midwest to discuss this acid rain issue.

This region of the country stands to suffer the most if acid rain legislation is passed and it is important that you hear the Midwest's concern about this issue, particularly those in the coal industry.

My name is Wayne Gresham. I am Vice President of Law and Governmental Affairs for AMAX Coal. AMAX Coal is based here in Indianapolis and is the third largest coal company in the United States, employing approximately 2,500 employees in three States: Indiana, Illinois and Wyoming. We produced approximately 38 million tons of coal during 1987.

My testimony today, however, is on behalf of the Indiana Coal Council—the ICC—a trade association representing approximately 90 percent of Indiana's coal mining industry and many of its suppliers.

During 1987, Indiana coal operators produced approximately 33 million tons of coal and employed approximately 5,000 miners.

Before I turn to House Bill 2666, let me give you a little background on the coal industry in Indiana.

Since its discovery in 1804, production has grown to represent a significant portion of Indiana's economy. During 1987, the Indiana coal industry injected nearly $20 million in State and local taxes into the Indiana economy. For every ton of coal produced, approximately 60 cents is paid by the coal industry in taxes. Of that 60 cents, 25 cents is paid in State and local taxes and 35 percent in local property taxes. Thus, we play a substantial role in keeping Indiana private citizens' tax rates low, particularly in the Southwestern portion of Indiana.

But survival in the coal industry is tough today and is getting tougher all the time. Out of State competition and decreased demand have caused prices to fall dramatically.

As a result, many of our members—former members, I should say—have gone out of business. And the United Mine Workers estimates that approximately 50 percent of their members are unemployed.

Yet, with this, over 26 million tons of out of State coal were imported into Indiana during 1987.

The electric utilities and industries which use out of State coal do so for a variety of reasons, but predominant among them are air quality requirements.

Indiana coal varies in sulfur content from half a percent to 6 percent, but approximately 95 percent of our coal is considered to be high sulfur.

As air quality requirements become more stringent, less and less of Indiana coal can be burned without blending or sulfur dioxide removal technology.

As has been pointed out by earlier testimony this morning, Indiana has made great strides in improving its air quality. Between 1980 and 1986, Indiana's $SO_2$ emissions have declined approximately 12.4 percent or about 195,000 tons. This trend will continue.

We expect that as a result of additional implementation of the Indiana SIP and other activities, utilities expect the $SO_2$ emissions to decline by about 25 percent from 1980 through 1996.

I participated last week in testimony before the Indiana Department of Environmental Management concerning the Indiana SIP, and contrary to some statements made earlier, 11 of Indiana's existing coal fired electrical utilities are going to have substantial reductions in their $SO_2$ limitations as a result of the final implementation of that plan.

The affected utilities' emission limits will be reduced from between 20 and 57 percent of their current emission limits.

These reductions are proof that the Clean Air Act today is working. Why not let it continue to work, without adding another complicated layer of reduction requirements?

The reduction requirements will, make no mistake about it, be achieved at cost, both monetary and human. Increased costs will be passed on to residential rate payers and industrial consumers of electricity. Indiana will become less attractive to new business. And people on fixed incomes will be adversely affected. More coal production will be displaced and more miners will be threatened with unemployment.

The Indiana mining industry and residential and industrial ratepayers are and will continue to pay for improved air quality without the passage of acid rain legislation.

The Indiana Coal Council opposes H.R. 266. The controversy continues. But one thing is certain. Bills like H.R. 2666 will cause significant displacement of Indiana coal production.

In a joint study, the Indiana Department of Commerce, Environmental Management Agency and the Indiana Utility Regulatory Commission analyzed H.R. 266 and projected that at least 3.4 million tons of local high sulfur coal would be displaced annually by imported low sulfur coal if 2666 is passed.

Of the 3.4 million tons displaced, 80 percent would be from Indiana mines. Thus, the displacement of Indiana production could exceed 3.7 million tons per year. The authors of that study say that it is conservative and actual displacement could be much higher.

As has been stated earlier this morning, we estimate that H.R. 2666 could cost nearly 1,000 direct mining jobs and nearly 3,000 related jobs and those are concentrated in the Southwestern counties of this State where the whole economy of many communities is based solely on mining revenues.

We are certain that the passage of H.R. 2666 will have a devastating economic impact on Indiana and would have serious economic implications on the Nation. Yet, it is much less certain that it would address effectively the acid rain controls.

The original claims that acid rain is causing immediate, widespread and catastrophic damage to the environment were wrong and greatly exaggerated.

We believe, in answer to Congressman Swift's questions earlier about what should Congress do, we believe it should focus its efforts on the development and deployment of clean coal technologies so that we are well prepared to address future air pollution and acid rain concerns.

The Nation's three largest coal producers, all of which are members of the ICC, alone spend over $20 million annually on coal research and development.

A substantial amount of industry's research is directed toward technologies which will accomplish two goals simultaneously: low cost energy and a healthy environment. These two need not be mutually exclusive.

We believe that the biggest danger that acid rain poses for the coal industry and Indiana citizens is that political expediency and Congressional impatience will cause the passage of legislation which will do nothing more than cause major economic disruption.

We have time. The Clean Air Act is working. Let us use that time to ensure that we are well prepared to meet the energy, environmental and human needs of the future.

Thank you.

[The prepared statement of Mr. Gresham follows:]

### Statement of Wayne E. Gresham

Good morning, Mr. Chairman, Representative Coats and members of the Energy and Power Subcommittee. Welcome to Indianapolis. We are delighted that you came to the heart of the Midwest to discuss the acid rain issue. This region of the country stands to suffer the most if acid rain legislation is passed and it is important that you hear the Midwest's concerns about the issue.

I am Wayne Gresham, Vice President of Law and Governmental Affairs for AMAX Coal Company. AMAX Coal Company, the third largest coal company in the United States, employs a total of approximately 2,500 employees in three States: Indiana, Illinois and Wyoming. AMAX produced approximately 38 million tons of coal during 1987.

I am testifying today, however, on behalf of the Indiana Coal Council (the "ICC"). The ICC is a trade association which represents 90 percent of Indiana's coal mining industry and many of its suppliers. During 1987, Indiana coal operators produced approximately 33 million tons of coal and employed approximately 5,000 miners. Of that 33 million tons, approximately 20 million tons were consumed by Indiana utilities. Twenty-six million tons of coal were imported into Indiana during 1987. Eighteen million of the 26 million tons of imported coal were used by Indiana utilities in 1987.

Before I turn to House Bill 2666, let me give you a little background on Indiana's coal industry. Since discovery of coal in Indiana in 1804, production has grown to represent a significant portion of Indiana's economy. During 1987, the Indiana coal industry injected nearly $20 million in State and local taxes to the Indiana economy. For every ton of coal produced, approximately 60 cents is paid by the coal industry in taxes. Of the 60 cents, 25 cents is paid in State taxes and 35 cents is paid in local property taxes. The property taxes paid by the coal industry play a substantial role in keeping private citizens' tax rates low, particularly in the southwestern portion of Indiana.

But survival in the coal industry today is tough and getting tougher all the time. Out of State competition and decreased demand have caused prices to fall dramatically. As a result, numerous Indiana coal companies have gone out of business, and the United Mine Workers estimate that approximately 50 percent of their Indiana miners are unemployed. Yet, over 26 million tons of out of State coal were imported into Indiana during 1987.

The electric utilities and industries which use out of State coal do so for a variety of reasons, but the predominate ones are the air quality requirements imposed on electric utilities and industrial users. Indiana's coal varies in sulfur content from 0.5 percent to 6 percent, and approximately 95 percent of Indiana's coal is considered to be high sulfur coal. As air quality requirements become stricter, less and less of Indiana's coal can be burned without blending or application of sulfur removal technology.

Indiana has made great strides in improving its air quality. Between 1980 and 1986, Indiana's $SO_2$ emissions have declined approximately 12.4 percent or by 195,000 tons. The trend will continue. A study performed for the Indiana Coal Council which is based on the 1980 emission levels quoted by the National Acid Precipitation Program ("NAPAP") projects that Indiana's $SO_2$ emissions from utilities are expected to decline by nearly 25 percent from 1980 through 1996. The $SO_2$ emissions limits will be reduced at 11 of Indiana's existing coal-fired electric utilities according to recent revisions to the Indiana $SO_2$ State Implementation Plan. The affected utilities' emission limits will be reduced from between 20–57 percent of their current emission limits. The reductions are proof that the Clean Air Act is working. Why not let the Clean Air Act continue to work without adding another complicated layer of reduction requirements.

Make no mistake about it, the reductions will be achieved at a cost: both monetary and human. The increased costs will be passed on to residential rate payers and industrial consumers of electricity. Indiana will become less attractive to new business. People on fixed incomes will be adversely affected. More coal production will be displaced and more miners will be threatened with unemployment.

The Indiana mining industry and residential and industrial ratepayers are and will continue to pay for improved air quality without the passage of acid rain legislation. If acid rain legislation is passed, the compounded effect on Indiana, its citizens and its coal mining industry would be devastating.

The ICC opposes H.R. 2666. The controversy about the causes and effects of acid rain continues, but one thing is certain: bills like H.R. 2666 would cause significant displacement of Indiana coal production. In a joint study, the Indiana Department of Commerce, the Indiana Department of Environment Management, and the Utility Regulatory Commission analyzed H.R. 2666 and projected that at least 3.4 million tons of local high sulfur coal would be displaced annually by imported low sulfur coal if H.R. 2666 is passed. Of the 3.4 million tons annually which will be displaced, approximately 80 percent would be from Indiana mines. An additional 0.9 million tons of Indiana production exported to out of State utilities cold be displaced. Thus, the displacement of Indiana production could exceed 3.7 million tons per year. The authors of the study admit that the study is conservative and that the actual displacement would be much higher if utilities decide not to install sulfur removal technologies.

The study projects that H.R. 2666 could cost nearly 1,000 direct mining jobs and nearly 3,000 related jobs. The authors project that coal revenues would drop by $90 million annually. The economic effects would be localized in 15 southwestern Indiana counties where the whole economy of many communities is based solely on mining revenues. Few alternative employment opportunities are available in these or adjacent counties to replace the lost mining jobs.

H.R. 2666 would not only have a dramatic effect on the Indiana mining industry, but as other witnesses will testify, the bill threatens virtually all of Indiana's manufacturing and industrial sectors as well. Electricity rate increases will be incurred at every level of manufacturing and production. Therefore, commercial, industrial and wholesale consumers of electricity will face increased costs. Businesses as diverse as grocery stores, retailers, heavy industry, primary metals and the furniture industries would be affected.

We are certain that passage of H.R. 2666 would have a devastating economic affect on Indiana and would have serious economic implications for the Nation. Yet, it is much less certain that it would address effectively the acid rain concerns. Increasingly, scientific evidence indicates that many of the original claims that acid rain is causing immediate, widespread and catastrophic damage to the environment were wrong or greatly exaggerated. Many of the original claims were based on flawed and erroneous historical data. The 1986 NAPAP Annual Report indicates that:

No adverse human health effects have been associated with acid rain;

Rain acidity at current levels will not cause irreparable harm in the foreseeable future; and

Acid rain . . . has no consistent demonstrable effect on the yield of agricultural crops.

Congress should focus its efforts on the development and deployment of clean coal technologies so that we are well prepared to address future air pollution and acid rain concerns. Congress has partially recognized the need for clean coal technology research. In 1987, Congress appropriated $575 million to be used for clean coal technology over the next 3 years. The Nation's three largest coal producers, all of which are members of the ICC, spend in combination over $20 million annually on coal research and development. A substantial amount of industry's research is directed toward technologies which will accomplish two goals simultaneously: low cost energy and a healthy environment. The two need not be mutually exclusive. Bills like H.R. 2666 make it less likely that these exciting new technologies will be developed and deployed because they will not be available in time to comply with the deadlines mandated in the acid rain bills.

The biggest danger that the acid rain issue poses for the coal industry and Indiana citizens is that political expediency and Congressional impatience will cause the passage of legislation which will do nothing more than cause major economic disruption.

We have time. The Clean Air Act is working in Indiana and in the Midwest as evidenced by the decline in $SO_2$ emission levels. Let's use the time to ensure that we are well prepared to meet the energy, environmental and human needs of the future.

Mr. **Sharp**. Thank you very much, Mr. Gresham. We now welcome Mr. Darrell Menscer, the President and Chief Operating Officer of Public Service of Indiana.

## STATEMENT OF DARRELL V. MENSCER

Mr. **Menscer**. Thank you, Mr. Chairman.

In order to conserve time, I will forego my presentation and just speak to the points that are in my abstract.

If you would like more detail later, I will be glad to do that.

Public Service Indiana is the largest investor-owned utility in the State of Indiana. We serve more than 560,000 in 69 counties.

We have cut our $SO_2$ emissions 17 percent between 1979 and 1987, even though during that time we increased our generation by more than 6 percent.

Speaking to the Gibson station—which carries the badge of being the largest emitter of $SO_2$—it also carries the badge of being the largest coal-fired generating plant in the United States. Those two kind of go together.

But through 1987, we have invested more than $149 million in emission control programs, including the construction of a scrubber for one of the Gibson plants. Our annual environmental expense exceeds $27 million.

The new Indiana State Implementation Plan will require an additional 18.9 percent reduction in $SO_2$ in addition to the 17 percent we have already reduced.

The reduction could cost between $50 and $290 million, depending on whether there is low sulfur coal available or we have to go to a scrubber.

The current bills before Congress we think reduce the flexibility many utilities, including ours, would have in devising a compliance strategy.

H.R. 2666 could require up to $1.3 billion in capital expenditures for our company alone and result in a 21.2 percent rate increase. These rates would hurt individuals as well as destroy Indiana's business economy.

We support the NAPAP program and we are at present providing generation and operational data to be used for the regional modeling studies that they are now doing.

But we believe that Congress should wait until this study is final and the report is issued before considering any acid rain legislation.

The real problem that bothers us is that if we spend all of these dollars and long range transport is not there and is not going to there, we are spending a lot of dollars that would not be necessary, that would not benefit the State of Indiana. And with that, sir, I conclude, and thank you for the opportunity.

[The prepared statement of Mr. Menscer follows:]

### TESTIMONY OF DARRELL V. MENSCER

Mr. Chairman and distinguished members of the subcommittee, I would like, first, to express to you my appreciation for the opportunity to testify this morning and share some of the concerns my company has over acid rain legislation now before the 100th Congress.

My name is Darrell Menscer and I am the President and Chief Operating Officer of Public Service Company of Indiana, Inc. PSI is the largest investor-owned electric utility in the State, supplying power to 563,626 customers in 69 counties. More than 98 percent of our power is generated at our six coal-fired powerplants in southern and western Indiana.

It isn't often we, in Indiana, have the chance to witness the workings of our legislative process right here in our own backyard. It is my hope that, by the time this hearing concludes, we'll have a better appreciation of each other's problems and responsibilities.

I would like to commend you, Mr. Chairman, for showing the foresight to schedule a hearing in the Midwest where much of our electric power is generated from the burning of locally mined coal. The acid rain issue is, purely and simply, a bread-and-butter one not just for PSI but also for the thousands of coal miners, small businesses, large industries and individual ratepayers in our region.

Over the years, Congress has been presented with a number of national studies showing the progress the electric utility industry has made in reducing sulfur dioxide emissions under the Clean Air Act. I'm not going to recite them this morning—they are already a part of the long congressional acid rain record with which, I know, you are quite familiar.

But I would like to acquaint this subcommittee with the steps we have taken to lower emissions from our generating facilities.

At Public Service Indiana, we cut sulfur dioxide emissions from 575,612 tons per year in 1979 to 477,898 tons in 1987—a reduction of 17 percent.

These reductions are even more important when one takes into account the fact that they were accomplished through a period of growth. During this same period, 1979 to 1987, PSI increased its generation 5.8 percent from 24.2 billion kilowatt-hours to 25.6 billion kilowatt-hours.

Through 1987, we invested $149.1 million in our emission control program. Our largest expense was the construction of a scrubber at our 676-megawatt Gibson Unit 5, which went on line in 1982. PSI's annual environmental expenses, including depreciation, are $27.8 million a year with the Gibson scrubber representing the lion's share of that commitment.

I know that, over the years, many in Congress have grown weary of the assertion that the current Clean Air Act still works. They seem to believe the law has run out of steam and no longer serves to reduce emissions.

Our recent experience, however, indicates otherwise.

Under the new Indiana State Implementation Plan, which EPA Region 5 is now reviewing, PSI will be compelled, by the end of 1995, to lower its sulfur dioxide emissions another 90,000 tons to just over 387,000 tons a year.

To meet this 18.9 percent system-wide reduction, we will cut allowable emissions 22 percent at our Cayuga Station, 24 percent at our Gallagher Station and 47 percent at Gibson Station.

Depending on what compliance strategy we use and other economic factors, we project our net present value of costs from these further emission reductions to fall somewhere between $50 million and $290 million.

What I hope this information does is leave you with two impressions: One, the Clean Air Act continues to do exactly what it was meant to do. And two, contrary to what you may have heard, Public Service Indiana and most of its fellow Midwestern utilities do not callously disregard our environmental responsibilities.

We have reduced emissions and we will continue to do so as required by the law.

Under the current Clean Air Act, we will be able to reduce emissions by nearly 19 percent while still maintaining the economic viability of the company.

These emission reductions will be made within a time frame that protects the economy of the State and preserves the thousands of jobs that depend on the Hoosier mining industry.

None of the bills introduced in Congress this year allows for this flexibility. Quite contrary. Their unrealistic deadlines tend to restrict compliance options and, if passed, would likely pit utility against utility.

The lower would be the consumer who would watch helplessly as electric rates increase dramatically as dependability decreases.

For example, H.R. 2666, whose provisions have already passed another subcommittee, could require PSI to construct six new scrubbers and install expensive new $NO_x$ technology by 1997.

We have projected our capital expenditures, under this bill, to be some $1.3 billion based on current scrubber costs. And the rate shock? In 1997, the first full year of compliance, our rates would have increased 21.2 percent.

For Hoosier consumers of electricity, especially the elderly and those on fixed incomes, such a dramatic increase in the cost of essential power would be devastating.

As for PSI's competitive rate structure, which has done so much to attract new business opportunities to Indiana, it would simply vanish. And so would the jobs.

Mr. Chairman, the congressionally mandated National Acid Precipitation Assessment program (NAPAP), in its interim report, indicates there is no environmental crisis at hand.

Absent the evidence that our emissions are permanently damaging lakes and streams downwind, how can we be expected to support draconian legislation such as H.R. 2666 which would wreck the Midwest's fragile economy?

PSI and many other electric utilities are cooperating with the NAPAP research by providing generating station and operational data to EPA's research branch. This information will be used to validate the regional acid deposition models which will be a part of the NAPAP final report.

We believe that final report, due in 1990, will provide Congress with the best science available on acid rain.

If the report shows that our emissions are, in fact, damaging the Northeast's environment, we know Congress will act in accordance with its responsibilities and pass appropriate legislation.

But until that report is out, we believe new acid rain legislation is premature and unnecessary. As long as Congress continues to propose bills that are based on emotionalism and politics and not reasoned science and economics, we will continue to oppose them.

Faced with the terrible burden these bills would have on our customers and the economic future of the State of Indiana, we really have no choice.

Mr. SHARP. Thank you very much. We now welcome Mr. Larry Reynolds, President of District 11 of United Mine Workers.

## STATEMENT OF LARRY REYNOLDS

Mr. REYNOLDS. Mr. Chairman, members of the committee, my name is Larry Reynolds, and I am President of the United Mine Workers for the State of Indiana.

I have been a coal miner for 25 years, over 10 years as President here in the State of Indiana. During this tenure in office I have faced many difficult and sometimes unsolvable problems.

I have faced numerous strikes, some of which have lasted up to 4 months. I have seen my membership through good times and bad times. I have seen my membership grow and I have seen it suffer.

I have witnessed unemployment, relief lines, angry and disappointed miners and many labor/management disputes. But throughout my tenure in office I have never been subjected to the human misery and wholesale unemployment that current acid rain legislation promises to deliver to my membership.

Coal miners work hard in a job that is often dangerous and dirty. But our work is critical for the economic well-being of our country and State. We believe in clean air and we believe in the enforcement of the Clean Air Act. After all, coal miners work in one of the most hostile and dangerous environments found anywhere on the face of the Earth.

But we also believe in the fairness of any proposed legislation that would address the acid rain issue. There is no fairness in Senate Bill 1894 offered by Senator George Mitchell of Maine, or House Resolution 2666, co-sponsored by Representative Henry Waxman from California, the two most prominent acid rain bills being debated in the 100th Congress.

Unemployment in the Indiana coal fields is over 50 percent and rising. We have seen the coal miners of our State and Nation not only sacrifice their livelihood, their jobs and their futures but also their lives, in pursuing supplying coal to meet current enforcement of the Clean Air Act. We owe a great deal to the men and women who risk their lives to provide us this valuable and important product.

That is why I am outraged that certain entities would want to further "reward" these coal miners for their sacrifices by mandating acid rain legislation. Proposed acid rain legislation would cripple and perhaps permanently destroy the coal industry in our Hoosier State and across the Midwest.

Attached to my remarks is a UMWA Analysis of House Resolution 2666, the most topical current acid rain legislation in Congress.

You will note that over 1,100 coal miners would lose their jobs in Indiana because of this one piece of legislation. This would displace nearly 3,000 related coal industry jobs. The total economic losses for these jobs would exceed $110 million each and every year.

This type of bleak outlook and assessment is clearly not acceptable to the coal miners in Indiana and across the Midwest. The total job loss impact and economic impact to our Midwestern States would exceed 32,000 coal miner jobs, 90,000 related jobs and cost the heartland of America $3.5 billion each and every year. These losses are in addition to increased utility bills for each and every electric consumer and the adverse effect of these utility costs on continued economic development.

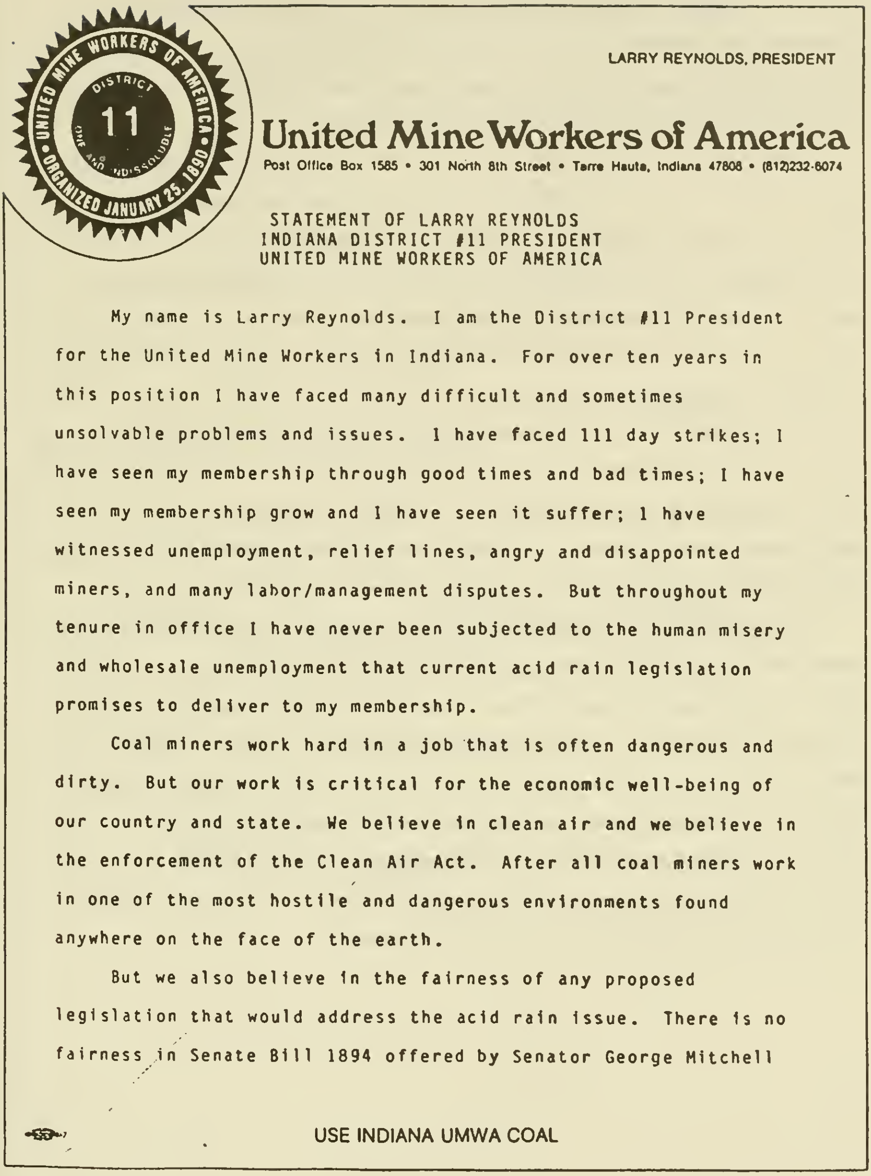
I mentioned our record is an excellent one. The Clean Air Act is working and coal miners do not need to be sacrificed for quick fix approaches.

I speak for all the coal miners in the State of Indiana and, I am sure, across the Midwest, when I tell you that the "endangered species" referred to in the acid rain debates are not the fish. The "endangered species" in this acid rain debate are the coal miners from Indiana, Illinois, Ohio and our other Midwestern States.

I appreciate the opportunity to address this committee and give my remarks. Thank you.

[Testimony resumes on p. 309.]

[The prepared statement and attachment of Mr. Reynolds follow:]



LARRY REYNOLDS, PRESIDENT

**United Mine Workers of America**

Post Office Box 1585 • 301 North 8th Street • Terre Haute, Indiana 47808 • (812)232-6074

STATEMENT OF LARRY REYNOLDS
INDIANA DISTRICT #11 PRESIDENT
UNITED MINE WORKERS OF AMERICA

My name is Larry Reynolds. I am the District #11 President for the United Mine Workers in Indiana. For over ten years in this position I have faced many difficult and sometimes unsolvable problems and issues. I have faced 111 day strikes; I have seen my membership through good times and bad times; I have seen my membership grow and I have seen it suffer; I have witnessed unemployment, relief lines, angry and disappointed miners, and many labor/management disputes. But throughout my tenure in office I have never been subjected to the human misery and wholesale unemployment that current acid rain legislation promises to deliver to my membership.

Coal miners work hard in a job that is often dangerous and dirty. But our work is critical for the economic well-being of our country and state. We believe in clean air and we believe in the enforcement of the Clean Air Act. After all coal miners work in one of the most hostile and dangerous environments found anywhere on the face of the earth.

But we also believe in the fairness of any proposed legislation that would address the acid rain issue. There is no fairness in Senate Bill 1894 offered by Senator George Mitchell of Maine or House Bill 2666 introduced by Representative Gerry Sikorski from Minnesota and co-sponsored by Representative Henry Waxman from Hollywood, California, the two most prominent acid rain bills being debated in the 100th Congress.

Unemployment in the Indiana coal fields is approaching 60% and rising. We have seen the coal miners of our state and nation not only sacrifice their livelihood, their jobs, and their futures, but also their lives in the pursuit of supplying coal to meet current enforcement of the Clean Air Act. We owe a great deal to the men and women who risk their lives to provide us this valuable and important product.

This is why I am so outraged that certain entities would want to further "reward" these coal miners for their sacrifices by mandating acid rain legislation. Proposed acid rain legislation would cripple and perhaps permanently destroy the coal industry in our Hoosier state and across the midwest.

There are only two practical ways at present to accomplish reductions of the magnitude required in current acid rain proposals. Utilities can either retrofit existing generating units with flue gas desulfurization devices (scrubbers) or switch to low sulfur coal. Make no mistake about it. Scrubbers can and do work. There are about 148 of them in the United States in operation today, representing 50,000 megawatts of electrical power. Nearly 100 more are under construction or in planning representing another 50,000 megawatts of power.

But scrubbers can be very expensive when retrofitted to existing plants. Since utilities managers often make economic decisions to maximize profit, they often resist the installation of pollution control equipment in lieu of the less expensive fuel switching of low sulfur coal.

Therein lies the problem.

Fuel switching means that existing coal supply contracts will be abrogated, coal mines will be idled and coal miners will lose their jobs. Attached to my remarks is a UMWA analysis of House Resolution 2666, the most topical current acid rain legislation in Congress. You will note that over 1,100 coal miners would lose their jobs in Indiana because of this one piece of legislation. This would displace nearly 3,000 related coal industry jobs. The total economic losses for these jobs would exceed $110 million each and every year.

This type of bleak outlook and assessment is clearly not acceptable to the coal miners in Indiana and across the midwest. The total job loss impact and eonomic impact to our midwestern states would exceed 32,000 coal miner jobs, 90,000 related jobs and cost the heartland of America three and a half billion dollars each and every year. These losses are in addition to increased utility bills for each and every electric consumer and the adverse effect of these utility costs on cointued economic development.

All of this when the existing Clean Air Act is working. Coal use in this country has increased from 625 million tons per year in 1977 to over 800 million tons per year in 1986. During this time sulfur oxide emissions have decreased from 27 million tons per year in 1977 to 21 million tons per year in 1986. Clearly the record is a good one. When you factor in the 100 new scrubber units that I mentioned earlier the record is an excellent one. The Clean Air Act is working and coal miners do not need to be sacrificed for quick fix approaches.

Many new and exciting technologies are on the verge of development and demonstration for existing plants. New clean coal technology can and will be in place before any acid rain controls would ever be mandated.

Now is not the time to run the coal industry out of Indiana and the midwest by forcing acid rain controls on an industry that has demonstrated the Clean Air Act is working.

I speak for all the coal miners in the state of Indiana, and I'm sure, across the midwest when I tell you that the "endangered species" referred to in the acid rain debates are not the fish. The "endangered species" in this acid rain debate are coal miners from Indiana, Illinois, Ohio, and our other midwestern states. The United Mine Workers will not and cannot stand idly by and watch this happen.

## UNITED MINE WORKERS OF AMERICA FACT SHEET

### Impact of House Resolution 2666

**Over 32,000 coal miners would lose their jobs.

With "free choice" of compliance techniques, utilities will adopt a less-cost strategy combining scrubbing and fuel switching. Fuel switching will displace 130 million tons of coal production annually, eliminating 32,000 direct coal mining jobs including over 1,100 in Indiana.

**Coal field communities will face severe social and economic upheaval.

The already severly depressed coal field communities of Indiana and the midwest will lose $3.4 billion in income annually. In Indiana this amounts to $110 million annually. This includes the income of coal miners and of workers in related industries.

**Foreign coal imports will increase.

The United States already is importing coal from South Africa and Columbia, displacing American workers. These imports are certain to increase if the mining of American coal is curtailed.

**Investment in clean coal technologies will be undermined.

More than 50 proposals to develop and demonstrate new technologies have been submitted to the U.S. Department of Energy. These include advanced designs for wet and dry scrubbers, fluidized bed combusition boilers and combined cycle coal gasification systems. All of these can be used for retrofit application and all will be available for commercial operation within the next decade. These technological innovations willnot be developed if billions of dollars of capital are diverted for immediate controls.

In addition:

** We will artifically eliminate the use of a large portion of our coal reserves.

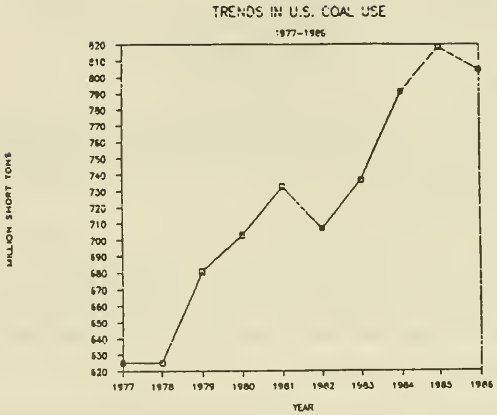
** Imports of electricity will increase.

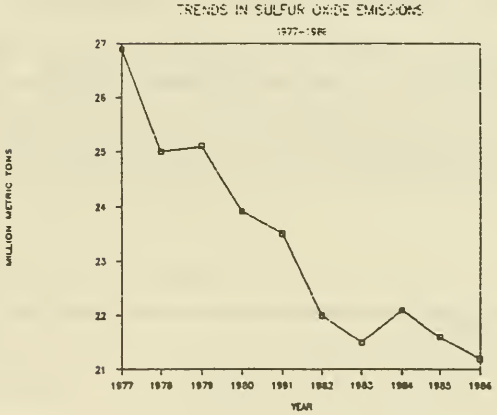
** Reliance on nuclear power will increase.

** The tax base of midwestern coal producing states will erode.

** The Congressional committment to clean air without massive job displacement will be reversed.

** Current state and federal committemtns to clean coal research will be overridden.





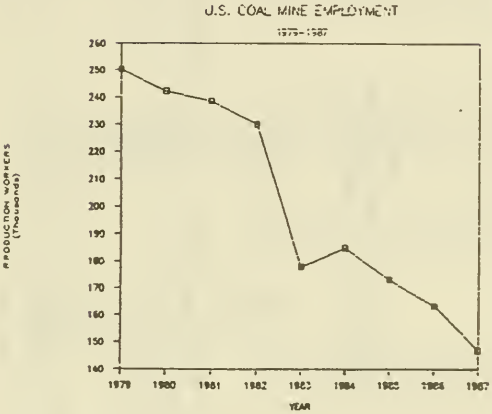
Source: Coal Use: U.S. Department of Energy, Energy Information Administration.

Sulfur Oxide Emissions: U.S. Environmental Protection Agency.

## U.S. Coal Mine Employment

## 1979-1987

| Year | Production Workers | Office Workers | Total Workers |
|---|---|---|---|
| 1979 | 250,226 | 10,203 | 260,429 |
| 1980 | 242,148 | 10,859 | 253,007 |
| 1981 | 238,557 | 11,181 | 249,738 |
| 1982 | 230,027 | 11,427 | 241,454 |
| 1983 | 177,673 | 10,300 | 187,973 |
| 1984 | 184,693 | 9,929 | 194,622 |
| 1985 | 172,951 | 9,452 | 182,403 |
| 1986 | 163,331 | 8,905 | 172,236 |
| 1987* | 146,871 | 7,837 | 154,708 |



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* Represents average employment in first nine months of 1987.

Source: Injury Experience in Coal Mining and Mine Injuries and Worktime, Quarterly, U.S. Department of Labor, Mine Safety and Health Administration.

## Production and Employment Displacement

## As a Share of Current Coal Industry

| | Coal Displaced (000 tons) | 1986 Coal Production (000 tons) | Miners Displaced | 1986 Coal Employment | Displacement As a Percentage of current Output and Employment |
|---|---|---|---|---|---|
| Alabama | 3,375 | 24,435 | 1,009 | 7,307 | 13.8% |
| Illinois | 13,515 | 62,871 | 3,064 | 14,254 | 21.5% |
| Indiana | 7,800 | 30,788 | 1,136 | 4,482 | 25.3% |
| Kansas | 500 | 526 | 133 | 140 | 95.1% |
| Kentucky | 28,580 | 145,191 | 6,529 | 33,170 | 19.7% |
| Maryland | 1,265 | 3,937 | 189 | 587 | 32.1% |
| Missouri | 3,650 | 5,574 | 741 | 1,131 | 65.5% |
| Ohio | 17,578 | 37,081 | 4,116 | 8,685 | 47.4% |
| Oklahoma | 725 | 2,388 | 240 | 789 | 30.4% |
| Pennsylvania | 24,750 | 65,483 | 7,069 | 18,073 | 37.8% |
| Tennessee | 1,775 | 6,691 | 682 | 2,571 | 26.5% |
| Virginia | 3,345 | 40,949 | 1,127 | 13,800 | 8.2% |
| West Virginia | 22,695 | 127,316 | 5,978 | 33,535 | 17.8% |
| | 129,550 | | 32,013 | | |

## Employment and Economic Consequences of H.R. 2666

| | Coal Displaced (000 tons) 1/ | Average Annual Output Per Miner (tons) 2/ | Miners Displaced | Average Annual Coal Mine Earnings 3/ | Direct Economic Losses ($millions) | Indirect Economic Losses 4/ Mulitiplier | Indirect Economic Losses ($millions) | Total Annual Economic Losses ($million |
|---|---|---|---|---|---|---|---|---|
| Alabama | 3,375 | 3,344 | 1,009 | $34,939 | 35.3 | 2.44 | 86.1 | 121.4 |
| Illinois | 13,515 | 4,411 | 3,064 | 36,804 | 112.8 | 2.74 | 309.1 | 421.9 |
| Indiana | 7,800 | 6,869 | 1,136 | 37,929 | 43.1 | 1.57 | 67.7 | 110.8 |
| Kansas | 500 | 3,758 | 133 | 34,206* | 4.5 | 3.23 | 14.5 | 19.0 |
| Kentucky | 28,580 | 4,377 | 6,529 | 31,459 | 205.4 | 2.28 | 468.3 | 673.7 |
| Maryland | 1,265 | 6,707 | 189 | 32,615 | 6.2 | 2.82 | 17.5 | 23.7 |
| Missouri | 3,650 | 4,929 | 741 | 34,206* | 25.3 | 2.90 | 73.4 | 98.7 |
| Ohio | 17,575 | 4,270 | 4,116 | 33,633 | 138.4 | 1.76 | 243.6 | 382.0 |
| Oklahoma | 725 | 3,027 | 240 | 27,220 | 6.5 | 2.71 | 17.6 | 24.1 |
| Pennsylvania | 24,750 | 3,501 | 7,069 | 32,397 | 229.0 | 2.25 | 515.3 | 744.3 |
| Tennessee | 1,775 | 2,602 | 682 | 25,482 | 17.4 | 2.34 | 40.7 | 58.1 |
| Virginia | 3,345 | 2,967 | 1,127 | 30,153 | 34.0 | 2.75 | 93.5 | 127.5 |
| Wast Virginia | 22,695 | 3,797 | 5,978 | 34,920 | 208.8 | 1.89 | 394.6 | 603.4 |
| | 129,550 | | 32,013 | | 1,066.7 | | 2,341.9 | 3,408.6 |

1/ Coal displacement derived from The Acid Deposition Control Act of 1986, H.R. 4567, Economic and Employment Consequences, United Mine Workers of America.

2/ Mine Injuries and Worktime, Quarterly, January - December, 1986, U.S. Department of Labor, Mine Safety and Health Administration.

3/ Employment and Wages, Annual Averages, 1986, U.S. Department of Labor, Bureau of Labor Statistics. Annual earnings in Kansas and Missouri were not divulged. U.S. average earnings were used for those states.

4/ The economic losses multipliers reflect the average relationship in each coal producing state between basic and non-basic income. Mining, agriculture and manufacturing income comprise the basic sector; total community earnings less basic sector income constitute the non-basic sector. Income information and total community earnings are taken from U.S. Department of Commerce, Bureau of Economic Analysis, Local Area Personal Income, 1978-1983 Volumes 3 (Mideast), 4 (Great Lakes), 5 (Plains), 6 (Southeast) and 7 (Southwest), (Washington, D.C.: Government Printing Office, 1985) Table 5 "Personal Income for States, Counties, and Independent Cities of the Region, 1978-1983." Multipliers were computed for the year 1983. Higher multipliers reflect the greater percentage of support, non-basic services in the economies of these states. In those cases, basic industry supports a greater volume of services. Lower multipliers tend to reflect more industrialized dependent economies. Metropolitan Washington, D.C. was factored out of the multipliers for Maryland and Virginia. It should be noted that the impact on the basic sector is immediate, whereas the impact on the non-basic will occur over time.

Mr. SHARP. Thank you very much, Mr. Reynolds. We now go to Charlotte Reed, the Executive Director of the Save The Dunes Council. Ms. Reed.

## STATEMENT OF CHARLOTTE REED

Ms. REED. Thank you very much, Congressman, and thank you all for coming to Northwest Indiana on a very important issue.

The Save The Dunes Council is a 36-year-old publicly supported citizen organization whose main focus for these three-plus decades has been preservation and protection of a very special Indiana resource, the Indiana Dunes along Indiana's Lake Michigan shoreline.

As watchdogs for a very small and very fragile natural resource, which is now a part of the National Park system, we have become early leaders in the fight for clean air in Northwest Indiana, and find we must continue that role today.

Northwest Indiana's three counties along the lake, Lake, Porter and LaPorte, are nonattainment, or unclassified, as we speak, for sulfur dioxide. Lake and Porter Counties are also nonattainment or unclassified for most of the rest of the criteria pollutants. This, 18 years after the enactment of the Clean Air Act.

The Council believes there is no other area in the State of Indiana where the promises of the Clean Air Act have failed so completely as they have there.

For example, four major electric generating stations and miscellaneous other sources of $SO_2$ stretch along a narrow band of Indiana's 45-mile shoreline along Lake Michigan.

Lake County, according to the Indiana Department of Environmental Management, in its SIP exercise, has 45 companies with over 163 stacks. The actual 1985 $SO_2$ emissions were 92,586 tons.

Porter County, neighboring to Lake County on the East, NIPSCO's Bailey Generating Station emitted between 39,000 and 60,000 tons of $SO_2$ per year between 1980 and 1985. Bethlehem Steel's Byrnes Harbor Works, the Nation's newest integrated steel mill, emitted 19,953 tons of $SO_2$ in 1985.

LaPorte County is not nearly as heavily industrialized, but its major source is a 500-plus megawatt coal-fired plant which disperses its heated water through a 380-foot cooling tower. This is our local acid rain factory.

The Sierra Club suit, as Mr. Maloney mentioned, forced EPA to begin to make Indiana develop State implementation plans for the control of $SO_2$ that were designed to eventually bring our area into compliance with the $SO_2$ criteria pollutant requirement.

As of this writing, none of the plans for the three Northwest Indiana counties have been EPA approved. IBEM, and I am sure if you ask anyone on the staff who deals with them, will tell you that it's $SO_2$ regulations, the present regulations and the proposed new regulations under the State implementation plan, are not designed to bring the State into compliance with any acid rain requirements, they are designed to begin, at least in our part of the State, to bring us into the $SO_2$ requirement that has been on the books for 17 years.

As I mentioned, the Save The Dunes Council's very particular interest is the Indiana Dunes National Lakeshore. The National Lakeshore has an air quality specialist, and he has been monitoring the acid rain as part of the National Atmospheric Deposition Program for some 8 years.

The pH of the rainfall varies, between 1980 and 1987, according to his 1987 report, and this is a net weighted average—the pH has ranged from 3.88 to 4.38. In 1987 it was 4.18—acid rain by any definition.

But when you look at averages, you have to realize, as I am sure you do, that averages are made up of the range of individual incidents. In 1985, the Indiana Dunes had the unfortunate distinction of experiencing one of the top ten most acid rainfall single events, with a pH of 3.38. And that is 166 times more acid than normal.

Studies that the National Park Service has done of air pollution damage to vegetation within the Indiana Dunes National Lakeshore—one by Butler University here in Indiana and one by the University of Minnesota—have found visible damage to sensitive species, in particular, the absence of many forms of lichen, a group of plants known to be vital indicators of pollution.

Reports of damage to boats moored near the NIPSCO Michigan City plant have appeared in the local newspapers for years. One of the advantages or disadvantages of citing the NIPSCO Michigan City example is that there are no other large major $SO_2$ sources near this particular plant.

Although not documented by the Council, it is widely believed that the utility—and I am a ratepayer for that utility—regularly pays to replace damaged canvas and refinish damaged hulls, decks, and rails from the numerous boats that are moored just downstream or downwind of the utility.

A very recent example involving the same utility involves a local museum housed in a historic lighthouse, also in Michigan City and also located just across from the NIPSCO plant.

Three times this year the museum's roof and windows have been showered with pollutants from this plant. Probably acid rain is a component and possibly other pollutants as well.

Unfortunately for the museum and for its dedicated volunteers, the situation has been going on for at least 7 years. To date, the local boat owners have had much better luck with the utility than the museum, which by the way is on our National Register of Historic Places.

Sulfur dioxide, acid rain, whatever you want to call it, is literally raining with frequency on this historic place.

The Council believes that the time has come to enact meaningful acid rain control legislation now. If not now, when? If not us, who?

At least in Northwest Indiana the sources that would have to clean up have, in our opinion, saved enormous amounts of money by not even complying with the present $SO_2$ standards.

We also support a stringent 1 hour $SO_2$ standard, something EPA is grappling with right now. And we would certainly request that if you gentlemen have anything to do with it, we would like to have a hearing on this proposal in Indiana.

We believe that the time to re-encourage and re-invent energy conservation as a way of controlling or minimizing acid rain is at hand.

We also believe that utilities should be encouraged or if need be, mandated, to manage their loads based on the least polluting, not necessarily just the least cost, units.

I would like to also, because Lieutenant Governor Mutz did mention Northwest Indiana in particular, I would like to by way of clarification, make some personal observations as a resident of the region.

For whatever reason, the electric rates in Northwest Indiana and our Utilities at Northern Indiana Public Service Company, have always been the highest in the State.

It is our understanding that industry can and usually does get a break in the rates, which means that generally the ordinary residential customer does not. To the extent that NIPSCO now uses high sulfur coal, they use Illinois coal and thy have for a long time. I presume that is for cost. I do not know. But the utility, NIPSCO does not use Indiana coal.

If you will notice in the Sierra Club chart, there is mentioned emission rates for major utility sources. In the NIPSCO Bailey plant, right now, that is the one closest to the Indiana Dunes National Lakeshore the permitted emissions rate is 6.6 pounds of $SO_2$ per million Btu. The proposal which has not been finalized is that rate, under the planned but not yet finalized State implementation plan for Porter County, would drop to 4 pounds. But the NIPSCO Michigan City unit, one of the tall stacks and the one with the cooling tower, would go from 5.3 pounds per million Btu to 6 pounds. We have real troubles with $SO_2$ SIP plans that make those types of compromises.

And if we do not clean up and if Lake County, which has suffered a good deal of problem from the problems of the steel industry, does not clean up and does not come into compliance with the $SO_2$ requirements, the construction ban on new sources of $SO_2$ will continue.

Our problems in Northwest Indiana with employment are not related to the prospect of acid rain control. They are much more complex than that. I believe that we can survive acid rain control. I think the time has come.

I believe that in this dialogue of what kind of controls should be enacted, and flexibility that undoubtedly needs to be required, that legislators must consult the public, the environmental organizations, the utilities, the electric users and the miners. But I think we need a dialogue involving all of us. And I think the time has come that we now take steps to control a problem that is not going to go away.

As a lover of my particular national park, and all national parks, I think we cannot afford to wait any longer until all our trees are dead, all our sensitive lakes are acidified and all our fish have rolled over and are no longer edible or swimmable or fishable. I think we have to bite the bullet. And I personally and my organization are willing to take our fair share of the cost of acid rain control.

Thank you.

Mr. **Sharp**. Thank you very much, Ms. Reed.

Let me ask Mr. Menscer if I might quickly ask one or two questions here.

As I understand, you are clearly advocating that we wait until NAPAP finishes before we try to determine a strategy and what if anything should be done.

But as my colleague from Washington has pointed out here very strongly, and one of the reasons for holding this and other hearings, is that that may not be the way in which things go in the U.S. Congress. And as I understand it, Public Service of Indiana certainly on most of these proposals has the prospect of taking the largest requirement, and potentially therefore the largest cost.

Could you articulate now, or if not now, at some point help us understand what factors could make the biggest difference in reducing the cost, the impact of that?

I put that very generally. But as a program is defined, one can go for longer deadlines, one can go for plant specific kind of proposals, as one originally did, which simply identified the 50 largest emitters. We have actually asked for work to be done on a proposal of trying to identify the most cost efficient plants, and ordered them by cost efficiency as opposed to necessarily the most pollution that is put out and see if there is a way to adjust a timetable to that as a way to hold costs down and yet achieve reduction.

I wonder if you folks either are prepared now or will be at some point to help us understand from the perspective of one of the utilities in the country and certainly in Indiana, what directions would make the most difference in terms of reduction?

Mr. **Menscer**. We will be glad to file with you something in more detail. But let me just speak to that a little.

As I said earlier, I spoke from the points in my abstract and discussed that we are going to be reducing almost 19 percent our $SO_2$ emissions under the new State implementations plan which is a part of the present Clean Air Act that we now live under.

In my write-up, that is being basically done at three of our major plants—22 percent reduction at Cayuga and 24 percent reduction at our Gallagher plant and 47 percent reduction at the Gibson Station, which is the large unit. This is a system whereby we are reducing the $SO_2$ over some time frame.

The way the Clean Air Act is now being handled, some studies that I have seen, put somewhere in the range of 2000, 2015, we would be at where we would be with a stringent requirement now. So we are reducing it. The Clean Air Act is working.

The real problem that we have is I guess two things. Number one, over the time frame, studies have shown that the Midwest, not just us, but the Midwest has reduced the amount of $SO_2$ it has put into the air, even though it has greatly increased its use of coal, by a significant number in the range of 25 percent. But yet we have not seen any reduction in the acidity of rainfall in New England.

So that raises a question in long range transport. How much of this is really getting there? Should we start at the source and when they reduce and show that it is coming from the outside, is that the right approach?

But if you want to go with the whole thing all over, then it has to be equally shared by everyone as to how it is paid for.

Mr. SHARP. Mr. Coats.

Mr. COATS. Mr. Menscer, you stated in your testimony what you had done in I think the last several years here in terms of reductions. Do you have an indication of what that cost, your cost, did to your rate structure?

Mr. MENSCER. We have invested about $150 million in environmental. I cannot remember exactly what our rate base is. That would not be a tremendously large percentage of our total rate base, which would be in the two, two and a half billion range.

Mr. COATS. That was to obtain the, I think you said 98,000 tons a year from 1979 to 1987?

Mr. MENSCER. 17 percent reduction, from 1979.

Mr. COATS. What was that figure?

Mr. MENSCER. 17 percent.

Mr. COATS. But what was the dollar figure? $150 million?

Mr. MENSCER. $150 million. Yes. The 17 percent reduction included the addition of several new units during that time frame which caused it to go up, but overall during the time we brought it down, because part of the Gibson plant has come in since that time.

Mr. COATS. Do you know the percentage of your annual expenses that you dedicate to environmental controls? Have you broken that out?

Mr. MENSCER. Our environmental expense is about $29 million a year.

Mr. COATS. And what percent is that of your total expense?

Mr. MENSCER. Our operating and maintenance expenses would run in the $200 million range but then fuel on top of that is probably another $400 million. So you are talking $600 million.

Mr. COATS. Just a question on clean coal technology I asked, I do not know if you were here earlier. You said that if H.R. 2666 passes you are going to have to put on about six new scrubbers.

Mr. MENSCER. Well, $1.3 billion in investment. That is correct.

Mr. COATS. $1.3 billion?

Mr. MENSCER. That is correct. It could be that high. That is correct.

Mr. COATS. And I presume you have looked at clean coal technology alternatives and come to the conclusion it just will not be ready in time to us as a viable option?

Mr. MENSCER. It would not be for backfitting lesions. Now, when you go forward, clean coal technology, such as fluidized bed, would be a good technology to use for the future in reducing sulfur dioxide.

Mr. COATS. Do you think that technology is currently available in mass scale production?

For instance, if you were putting a new plant, made a decision now to put a new plant on line, what technology would you employ in that new plant?

Mr. MENSCER. Well, our immediate future would be in combined cycle units, run on either Number 2 distillate or natural gas, so we would not be using the coal. We are looking to those units to use gassified coal. As we move on out of this, the technology would prove in to where we could take the coal, gassify it and then put it through these combustion turbines.

Mr. Coats. Are you involved in any of the demonstration projects?

Mr. Menscer. No. We made a proposal on the injection system which was given to the State or a company in Ohio who were proposing basically the same technology, and then since that proposal we have been recovering from our Marble Hill situation and have not had the finances to propose another project.

Mr. Coats. One last question. Have you looked into the problem of sludge disposal from scrubbers? If you put on six new scrubbers, what kind of additional disposal problem are you going to create for yourself and how do you deal with that?

Mr. Menscer. At the present time, we have a limestone scrubber on the Number 5 unit at Gibson which does produce a large amount of sludge. We are fixating it and putting it into a disposal area at this time which will be built into a hill or mountain somewhere in the range of 200 feet high by the time the site is utilized.

We are trying to work with the State and with EPA to get permission to move some of this fixated sludge back into the surface mines and then be put in those mines and covered in the store.

Mr. Coats. I wanted to raise that because often we tend to assume that we throw a scrubber on and that takes care of all of our disposal problems and pollution problems and environmental problems. And often it just creates an additional problem which we have to deal with.

Mr. Menscer. That is correct. We just change the problem from one form to a second one.

Mr. Coats. Thank you, Mr. Chairman.

Mr. Sharp. The gentleman from Washington.

Mr. Swift. Thank you. Mr. Gresham I note that at Page 6 of your testimony you say, and I am kind of wondering what your interpretation is to that: It could be read—the 1986 NAPAP annual report indicates that the rain acidity, the current levels will not cause irreparable harm in the foreseeable future. Acid rain has no consistent, demonstrable effect in the yield of agricultural crops.

Now, I am a politician and I know something about using qualifiers myself.

And you could also interpret this as saying the 1986 NAPAP annual report indicates that acid rain at current levels will not cause irreparable harm for the foreseeable future. And acid rain has no consistent demonstrable effect on the yield of agricultural crops.

Which is your interpretation?

Mr. Gresham. In regard to the Congressman and his background, I probably could have done with a bit of editing on your part along the lines you suggest.

Mr. Swift. The point was just to indicate that I think NAPAP is getting thrown around here by everybody kind of like the Bible. You can prove anything you want with it if you select and add enough qualifiers. And I just wanted to remind you of the advice of "don't kid a kidder."

One question really is all I had. I really have a lot of sympathy for the idea of continuing to do clean coal research.

Is it not—depending on how you configure the acid rain legislation—is it not possible to put in place some legislation that will be phased in an appropriate fashion so that any breakthroughs in clean coal technology that would come in the reasonably near future—could of qualifiers there—in the reasonably near future could be considered—in other words, you would not force at the earliest stages all units into expensive scrubbers and what have you—and you could come up with some means by which clean coal could still be a potential part of a solution within the overall 10-year, whatever would be the phase-in time.

And if we could do something like that, would that be better for you than, say, the Waxman bill just the way it sits?

Mr. Gresham. Well, with due deference to your qualifiers, assuming that any sort of acid rain legislation were to be enacted, I believe the aluminum company current has a proposal that I have seen a summary of somewhat along the lines that you are talking about, Congressman, sort of a take a look and see at various periods along the way, has clean coal technology done enough that we could either eliminate these further reductions or phase them out or push them out farther. I think that sort of a concept has a lot to say for it.

To impose standards now that are inflexible as we go forward and do not take into account what happens between now and say 1996 or 2003 or 2010, whichever bill it might be, I think is very shortsighted.

Mr. Swift. I do not know what we can do. But it is certainly an area to explore and see if it is not possible to get the job done and still build in some flexibility so that your companies and Mr. Reynolds, your workers, do not pay too high a penalty for having us be able to clean up the air a little bit.

Mr. Chairman, I yield back my time.

Mr. Sharp. The gentleman from New Mexico.

Mr. Richardson. Thank you, Mr. Chairman. Let me ask my first question of Mr. Reynolds, and play a bit of a friendly devil's advocate. Because I enjoy a very positive relationship with your union and in fact, you have a large presence in my State.

But what about the argument that I might ask some of my coal miners in my State that eventually if this country starts shifting towards clean coal technology, that the jobs that might accrue in the West, that there might be an expansion of the industry there?

I know it is rather simplistic. And that does not mean that I am suggesting that regional division. But I wonder, Mr. Reynolds, if you have looked at that issue of the job impact of developing more clean coal technology and developing in regions of the country where that coal is of lower sulfur content.

I wonder if you could take a shot at that?

Mr. Reynolds. Certainly. I believe it would be a very selfish point of view on your part to do that.

However, that has been looked at even by different segments of our union as a benefit in others and hurting other parts of the country.

I do believe that overall they have looked at it and most people, I believe the analysis will be that over a period of time, one of the things that affects utility rates, economic development, so on and so forth, but especially upon the utility rates, will be the transportation of coal. And how you transport that power, that coal back to the Midwest, could have a tremendous effect upon what utility rates will be in the next 5, 10, 20 years, because a 10 percent increase in transportation could involve a significant amount of coal. You know, that is more than what the coal is worth at mine mouth, to get it back here.

An example, most Western coal will sell for somewhere in the neighborhood of $8 to $12 a ton. To transport it back to the State of Indiana, total cost is going to be $80 a ton.

So a 10 percent increase on $70 is going to be more than what it would be to clean the coal up back here.

So given that logic, I believe that you would totally economically devastate the entire Midwest by the high cost of energy.

Mr. Richardson. I would like to ask Mr. Menscer, if the statistics that I read are correct, that you have been applying and contributing quite a bit to scrubbers and technology. And if that is the case, I wish to commend you. But I guess my question emanates from one of the points you made.

You would like to see this study concentrate more on a regional model. And it was in your conclusion statement. And I wondered if you could amplify on that. Have you been discussing a possible solution to this issue on a more cooperative basis with your fellow utility presidents in the Midwest? Would the Ohio President of Public Service Company be saying exactly the same thing you are?

Mr. Menscer. Well, I think the point I was trying to make is, the long range transport, how far does the $SO_2$ that we emit go? You know, who is it really affecting? As the gentleman testified earlier, in the studies that they have done, we have an underlayment of limestone in Indiana. That part that falls in Indiana, a good portion of it is absorbed in the limestone, so it does not gather in lakes and we do not have the problem. I am not saying by any imagination that that would be the only problem that it would cause. I do not mean that.

But what I am saying is, what falls on Indiana and Indiana crop lands, why would we want to spend billions of dollars to stop emitting that here if that is the only place that it is falling and it is not doing damage there?

That small portion that goes on to Ohio and Ohio on and keeps accumulating, the long range transport—that is what we have been looking at. As I said earlier, we have reduced—in the Midwest, not just us, but in the Midwest we have reduced about 25 percent.

When you reduce 25 percent and you see no perceptible change, you begin to wonder if we went 50 percent do we see a change or we go 75, do we see a change, or is the problem really more a localized problem that they would rather us do something about? And we cannot solve that problem.

That is why I think NAPAP is looking regional, they are looking local, they are trying to determine what are the long range effects of this. Florida—Florida cannot be getting Midwest unless it is going all the way around the world and coming back some other way. The currents just do not flow there.

Mr. Reynolds. I notice that my dear Chairman is getting anxious.

Mr. Sharp. I might have to use the gavel. Let me do this. I think we would all like to have some more questions. Let me ask Ms.

Reed if she had any comments she wanted to make. We did not get a chance to direct any directly at her. I will give her an opportunity if she wants to respond to anything she has heard.

Ms. REED. I appreciate that. You know, as a human being, I am not unsympathetic to increases in rates, in electric rates. I am not unsympathetic to miner's jobs, either. I think we talk about flexibility. I think there is a balance here as well. And I do have to agree with the same speaker that sat in my chair and so eloquently discussed what would be termed the secondary impacts.

Northwest Indiana is very clearly suffering secondary, if you would want to call them that, secondary impacts. We are not turning Lake Michigan into an acid pit. But we are damaging our trees. We are damaging our buildings. And I submit we are also damaging our health. You were not necessarily supposed to have the answers on the day the President signed the bill into law. But do you have to do a body count and find out too late there was a problem? I hope we will not do that.

Mr. SHARP. Ladies and gentlemen, thank you for your time and attention to this. We would be interested in further pursuing with you some more of the specifics as we get into concrete legislation. Thank you very much for coming.

We have one more panel, and in just a moment, we will hear them.

We will make all your written material part of our written record.

Mr. SHARP. And we will be happy to hear your oral presentation at this point.

Ms. Kress, we are happy to hear from you.

## STATEMENT OF EMILY KRESS, PRESIDENT, INDIANA WILDLIFE FEDERATION; H. LLOYD GOOD, DIVISION DIRECTOR, AMERICAN MAIZE PRODUCTS CO., ON BEHALF OF INDIANA INDUSTRIAL ENERGY CONSUMERS, INC.; AND EDWARD R. VENNON, PRESIDENT, INDIANA MANUFACTURERS ASSOC., AND ON BEHALF OF INDIANA STATE CHAMBER OF COMMERCE

Ms. KRESS. Thank you.

Mr. SHARP. Just a second. Let me just get a little more order in the room, if our audience will help us out. We want to be able to hear. Ms. Kress?

Ms. KRESS. I will limit my remarks and just highlight the comments that you have, and I trust you will take into consideration the entire contents at some later time.

My name is Emily Kress. And as President of the Indiana Wildlife Federation, I speak here on behalf of our 20,000 members in Indiana and the over 5.1 million members of the National Wildlife Federation with whom we are affiliated. I thank you, Congressman Sharp, for the opportunity to testify.

The Indiana Wildlife Federation and the National Wildlife Federation have been pressing for acid rain controls for 8 years. We emphasize the urgent need for acid rain legislation without further delay.

It is clear that the acid rain predicament is getting worse. The decision we must make is not if we will make emissions reductions, but how much, at what rate and at whose expense.

An extraordinary proliferation of scientific scholarship and policy study has moved the acid rain issue to the forefront of congressional debate. There now exist several journals and newsletters solely devoted to the subject of acid rain. More than 3,000 scientific papers have been published over the last 15 years documenting the cause and effects of man-made acid rain. In addition, almost every State is carrying on its own investigations.

Each study registers acid rain's exacting price. We pay with our natural resources, with our crops and materials, with our very health.

The most publicized cases of acid rain damage have been in the East. The Office of Technology Assessment classified 25 percent of the land in the Eastern 31 States as sensitive. Perhaps nothing more than dead and dying fish signify the ravages of acid rain. The demise of at least 212 Adirondack lakes, lakes where people used to fish and swim, is attributable to acid rain.

The Congressional Research Service reports that the economic losses from degradation of land and water as a result of acid deposition at $1.75 billion for forests and $250 billion for aquatic resources.

There are indications that what the Eastern half of the country now suffers, the Western half may suffer in the future.

A recent study showed that acid emissions of nitrogen oxides contributes to the loss of life and dependent livelihoods in the Chesapeake Estuary. This is significant, given that all previous damage was derived from the study of fresh water bodies.

Even if one never fished or never set foot in a forest, one would still be subject to the effects of acid rain. It reduces agricultural productivity. Experiments show that acid rain significantly reduces the yield of corn and soybeans.

Building and automobile materials suffer from acid rain as well, adding substantially to the cost of maintenance.

In the discussion about acid rain's detrimental effects, people often overlook the fact that sulfur dioxide is a criteria pollutant, that shares a place with lead and carbon monoxide as a health hazard.

Those with any respiratory or heart problems, as well as the 133.4 million people under the age of 17 years and over 65 years old, are particularly at risk.

A Massachusetts Institute of Technology study estimates that sulfates are a major factor in as many as 50,000 premature deaths in Northeastern North America each year. All this illness makes us pay in suffering what we might be expending in pollution control.

The litany of acid rain consequences and costs suggests a serious problem that is national in scope, not only because it affects the natural endowment and coffers of the entire country, but also because it is a problem often created in one State and exported to another.

The coal burning plants in this valley emit over one third or 25 million tons of the Nation's airborne sulfur dioxide and send it in plumes East and North. Indiana and Illinois are heavy polluters. They are embroiled in an interstate conflict that does not need to be. Eastern States are frustrated by attempts to deal with the interstate problems. Middle and Western States are beginning to experience the adverse effects of acid rain.

Something will be done. But uncertainty about timetables and methods forbids prudent planning. With the adoption of national legislation, squabbling States will be able to preserve jobs while respecting both the economic and health interests of their ratepayers.

Title II of S. 1894, the Senate Environment and Public Works Committee Clean Air Bill, would work.

The Senate bill calls for a 12 million ton, three-stage reduction in sulfur dioxide emissions by the year 2000. The bill includes provisions that would allow States to tailor reduction plans to their own needs.

A clean coal technology program would help ease future reductions in emissions as would new source information standards.

But leaving aside the details, the most important aspects of both the House and Senate bills are tonnage, timing and distribution. The proposals halve the tons of acid rain and also spread the burden over the entire Nation.

The House bill includes a utility rate subsidy program to protect ratepayers in heavy polluting States. Such a program would use a nationwide emissions tax to ensure that residential rates in any one area would not increase by more than 10 percent. The Senate bill has no such subsidy.

These are things that can be worked out. We are willing to consider alternative methods of cost sharing as well as different cleanup techniques. It is possible to provide the Nation with clean air while devising strategies to secure jobs.

The acid rain crisis is a 50-State problem to be solved by all 50. Heavy polluting States like Indiana will do their share but they should not be expected to shoulder the entire burden.

An equitable solution to the acid rain problem is both economically feasible and justified. The most recent CRS analysis of S. 1894 criticizes inflated costs estimates, yet these estimates fail to consider the cost of doing nothing or of a default EPA strategy in the absence of legislation.

There will be an acid rain program. The question is how much will an equitable and sufficiently rigorous program cost?

We hear continually of the jobs that would be lost because of air pollution controls. We have two responses.

First, the States can choose control strategies that spare the bulk of the cola dependent jobs in their regions. Many more mining jobs have and will fall to automation than ever need fall to acid rain control.

Second, the apparatus of air pollution control has tremendous job producing capabilities. Pollution control is a multi-billion dollar industry.

To delay acid rain legislation is to waste precious time and to invite escalation in costs. On the contrary, the sooner we put a reduction schedule into effect, the more painlessly and equitably we can redress the ills of acid rain.

We urge you, Representative Sharp, and the Energy and Power Subcommittee, to expedite passage of an acid rain bill. There has been more than enough discussion already and we can afford no more. The ratepayers and the miner workers in this State and others deserve a resolution to this problem. It is in their best interests and those of the entire Nation to act as quickly as possible.

Thank you.

[Ms. Kress's prepared statement follows:]

## STATEMENT OF EMILY KRESS

My name is Emily Kress. As President of the Indiana Wildlife Federation, I speak here on behalf of our 20,000 members in Indiana and the over 5.1 million members of the National Wildlife Federation of whom we are affiliated. I thank you, Congressman Sharp for the opportunity to testify. The Indiana Wildlife Federation and the National Wildlife Federation have been pressing for acid rain controls for 8 years. We emphasize the urgent need for acid rain legislation without further delay. It is time to recover the natural and material wealth that daily washes away in acidic deposition. It is time, too, to minimize the health risk that acid rain poses.

It is clear that the acid rain predicament is getting worse; the problems we face are grave. Mountains of evidence show acid rain is costly, it is caused by $SO_2$ emissions, and some sort of controls are absolutely necessary. The question now before us is what sort of controls? The decision we must make is not "if" we will make emissions reductions but how much, at what rate and at whose expense.

An extraordinary proliferation of scientific scholarship and policy study has moved the acid rain issue to the forefront of Congressional debate. There now exist several journals and newsletters solely devoted to the subject of acid rain. More than 3,000 scientific papers have been published over the last 15 years documenting the causes and effects of man-made acid rain. In addition, almost every State is carrying on its own investigations as to the acid sensitivity of its lakes, streams, forests, crop lands, and human population. NAPAP, the national study, carries on in the second half of its decade long examination of the problem. Western Europe and Canada have given even more attention to the acidification of their natural resources and lead the United States in controlling atmospheric sulfur.

Each study registers acid rain's exacting price. We pay with our natural resources, with our crops and materials, with our very health. Sulfur that goes up in the air as a gas comes down in rain, snow, and fog as sulfuric acid. This acid defoliates forests and takes the life out of sensitive water bodies. The most publicized cases of acid rain damage have been in the East, particularly the Adirondacks in the North and the Appalachians in the South. Here, thin, rocky, or already acidic soil is especially vulnerable to heavy dousings of acidic precipitation. The Office of Technology Assessment classified 25 percent of the land in the eastern 31 States as "sensitive." This includes 17,000 lakes and 112,000 miles of streams. Perhaps nothing more than dead and dying fish signify the ravages of acid rain. The demise of at least 212 Adirondack lakes, lakes where people used to fish and swim, is attributable to acid rain. It has threatened half of West Virginia's trout with extinction, damaged 15 percent of the lakes and jeopardized another 2,600 lakes in Minnesota. According to the National Academy of Sciences, "at current rates of emission of sulfur and nitrogen oxides, the number of affected lakes can be expected to more than double by 1990, and to include larger and deeper lakes." The cost of acid rain rises as we deliberate. The Congressional Research Service (CRS) reports that the economic losses from degradation of land and water as a result of acid deposition at $1.75 billion for forests and $250 million for aquatic resources.

There are indications that what the eastern half of the country now suffers, the western half may suffer in the future. The average precipitation in Glacier National Park has been measured at five times more acidic than unpolluted rain. High elevations and granite bedrock make high mountain lakes vulnerable to acidification.

A recent study by the Environmental Defense Fund shows that acid emissions of nitrogen oxides contribute to the loss of life and dependent livelihoods in the Chesapeake Estuary. This is a significant finding given that all previous damage was derived from the study of fresh water bodies.

Even if one never fished or never set foot in a forest, one would still be subject to the effects of acid rain. It reduces agricultural productivity by poisoning or starving the root system. Experiments show that acid rain significantly reduces the yield of corn and soybeans, tallying economic losses between nearly $1 and $2.1 billion annually in the East. A study cited by Congressional Research Service indicates that a 50 percent reduction in wet acid levels will produce a benefit of $140 million (1980 dollars).

Building and automobile materials suffer from acid rain as well, adding substantially to the cost of maintenance. Three of the four pollutants that cause the most damage to building and statuary materials are acid rain-related. Like the Acropolis in Athens, many American monuments including the Statue of Liberty and the Lincoln Memorial are deteriorating. As a Nation we must decide whether we care enough about our cultural heritage to reduce the chemicals that steal it away. The incentive to curb the acid rain may come from no farther than our own front door. According to one estimate, residential property values in the United States would increase by $2.3 billion per year with a 20 percent reduction of particulate and sulfur dioxide pollution. Buildings would collect comparable savings.

In the discussion about acid rain's detrimental effects, people often overlook the fact that $SO_2$ is a criteria pollutant. It shares a place with lead and carbon monoxide as a health hazard. Recent studies have indicated that the American population may be susceptible to $SO_2$ at even lower levels than previously thought. Breathing sulfate pollution increases the likelihood of heart and circulatory failure. Those with any respiratory or heart problems, as well as the 133.4 million people under the age of 17 years and over 65 years old, are particularly at risk. A recently completed study at the University of California, San Diego, School of Medicine, finds a "strong positive association" between levels of $SO_2$ and both colon and breast cancers. Even more striking is a Harvard university finding that the combined effects of particulate and sulfate pollution cause 5 percent of all deaths in the average polluted urban area. An earlier Massachusetts Institute of Technology study estimated that sulfates are a major factor in as many as 50,000 premature deaths in Northeastern North America each year.

All this illness unduly taxes our medical system and makes us pay in suffering what we might be expending in pollution control. The American Lung Association surveyed the latest cost studies and concluded that the health consequences of air pollution cost perhaps $40 billion per year in health care and lost productivity.

This litany of acid rain consequences and costs suggests a serious problem that is national in scope. It is national not only because it affects the natural endowment and coffers of the entire country, but also because it is a problem often created in one State and exported to another. How can it be that the rain falling in Kentucky, Ohio, West Virginia, Pennsylvania, and New York is 25 to 30 times more acidic than normal? The unhappy accident of geography has placed this sensitive ground directly in the way of emissions from the industrial Ohio River Valley. The coal burning plants in this Valley emit over one-third or 25 million tons of the Nation's airborne $SO_2$ and send it in plumes east and North. Indiana and Illinois are heavy polluters. They are embroiled in an interstate conflict that does not need to be. The casualties of this conflict are not just the New England lakes and forests but the health and economic vigor of the entire Nation. Eastern States are frustrated by attempts to deal with this interstate problem within their own jurisdictions; middle and western States are beginning to experience the adverse effects of acid rain. All know something will be done but uncertainty about timetables and methods forbids prudent planning. It is possible, and indeed there are proposals pending in the Congress, to deal equitably with acid rain. With the adoption of national legislation, squabbling States will be able to preserve jobs while respecting both the economic and health interests of their rate-payers.

Title II of S. 1894, the Senate Environment and Public Works Committee clean air bill, would work. It is similar to Title I of H.R. 3054, which passed the House Health and Environment Subcommittee. The Senate bill calls for a 12-million-ton (50 percent), 3-stage reduction in $SO_2$ emissions from 1980 levels by the year 2000. The bill includes provisions that would allow States to tailor reduction plans to their own needs. A clean coal technology program would help ease future reductions in emissions as would new source performance standards. But leaving aside the details, the most important aspects of both the House and Senate bills are tonnage, timing, and distribution.

The proposals have the tons of acid rain precursors over a time period that is both prudent and feasible. They also spread the burden over the entire Nation.

The House Bill includes a utility rate subsidy program to protect rate-payers in heavy polluting States. Such a program would use a nationwide emissions tax to ensure that residential rates in any one area would not increase by more than 10 percent. The Senate Bill has no such subsidy. These are things that can be worked out. We are willing to consider alternative methods of cost-sharing as well as different clean-up techniques. It is possible to provide the Nation with clean air while devising strategies to secure jobs. What we insist upon is a 12 million ton reduction by the year 2000. We also insist that the country recognize the acid rain crisis as a 50-State problem to be solved by all fifty. Heavy polluting States like Indiana will do their share but they should not be expected to shoulder the entire burden.

The facts support our proposition that an equitable solution to the acid rain problem is both economically feasible and justified. The most recent CRS analysis of S. 1894 criticizes inflated cost estimates, yet these estimates fail to consider the cost of doing nothing or of a default EPA strategy in the absence of legislation. There will be an acid rain program. The question is how much will an equitable and sufficiently rigorous program cost? CRS has put Title II's net cost between 0 and $6 billion. According to several studies, this cost would be offset by benefits accruing from acid rain control. Needless to say, many of the things we gain from reducing emissions cannot be quantified. An EPA report, however, examines the monetary effects on health and welfare of alternative $SO_2$ standards. It listed 44 categories of benefits. The impact on only 8 of these would range from $4.4 to $6.5 billion a year.

We hear continually of the jobs that would be lost because of air pollution controls. We have two responses. First, States can choose control strategies that spare the bulk of the coal dependent jobs in their region. Many more mining jobs have and will fall to automation than ever need fall to acid rain control. Second, the apparatus of air pollution control has tremendous job producing capabilities. Pollution control is a multi-billion dollar industry. One management consultant in 1985 found that it provided more than 166,000 jobs and created more than $19 billion in sales. An analysis by the Industrial Gas Cleaning Institute reveals that a 10–12 million ton $SO_2$ reduction requirement could create between 4,500 to 15,000 lifetime jobs.

To delay acid rain legislation is to waste precious time and to invite an escalation of costs. On the contrary, the sooner we put a reduction schedule into effect, the more painlessly and equitably we can redress the ills of acid rain. We urge you, Representative Sharp and the Energy and Power Subcommittee to expedite passage of an acid rain bill. There has been more than enough discussion already and we can afford no more. The ratepayers and mine workers in this State and others deserve a resolution to this problem. It is in their best interests and those of the entire Nation to act as quickly as possible.

Mr. SHARP. Thank you very much. Mr. Good, you are next.

## STATEMENT OF H. LLOYD GOOD

Mr. GOOD. Thank you, Mr. Chairman and Members of the Committee.

I would like to make a slight correction to my title. I am employed as Division Director of Purchasing for American Maize Products, Corn Processing Division. And our main plant is located up in Hammond, Lake County, Indiana and we have been in business since 1906 and manufacture corn, wet milling products such as corn starches, corn syrups and animal feeds.

I am here today to present testimony on behalf of the Indiana Industrial Energy Consumers, Inc., known as INDIEC, and, as Chairman of INDIEC, wish to thank this subcommittee for the opportunity to present its position on acid rain.

The Indiana Industrial Energy Consumers (INDIEC) is a group of 30 industrial users of energy in Indiana. In 1984, INDIEC members spent over $390 million on electricity and $490 million on natural gas purchases. In addition, INDIEC members contribute over $1.6 billion to the Indiana economy, employ some 90,000 people at 95 locations and pay over $125 million in State and local taxes. INDIEC advocates the availability of adequate and secure long-term supplies of electricity at reasonable rates. In order to promote this concept, INDIEC endorses the following position with respect to acid rain:

Number one: Additional mandated emission control programs in the United States are not warranted at this time; (2) Increased funding for clean coal technologies and demonstration projects should be considered; (3) Research into all aspects of acid rain phenomena should be continued to define the issues accurately and identify cost justified solutions; (4) A cost/benefit analysis of proposed legislation should be conducted prior to passage to ensure that required costs are justified, and (5) Currently proposed legislation unduly impacts Indiana ratepayers and Indiana customers in particular.

So INDIEC continues to believe that the scientific debate is yet unresolved. The analysis of acid rain phenomena continues. Scientists have gained knowledge and are closer to defining the links between $SO_2$ and $NO_x$ emissions and acidity in precipitation.

However, the extent of any linkage between acidity in precipitation and damage to the environment or between reduction in emissions and improvement in the environment remains a subject of continuing scientific debate.

Emissions of $SO_2$ have declined significantly in recent years and is expected to continue to decline in the future without additional controls. IN 1983, $SO_2$ emissions in the United States were 28 percent below their peak level in 1973. Electricity utility $SO_2$ emissions declined 19 percent during this period despite a 60 percent increase in utility consumption. Legislating emission reduction at this time is premature.

Many studies are underway, funded by the Federal Government, utility industry and others. These studies are crucial and should be completed and their findings analyzed before legislation mandating a major emission reduction program is proposed.

We also believe that proposed reduction programs are costly. Estimates of the cost of emission reduction programs vary significantly. However, all such studies show that the costs are very large. The Office of Technology Assessment, OTA, estimates the costs between $3.4 billion and $4.3 billion per year and the Edison Electric Institute predicts that as applied to electric utilities, the bill could cost up to $9.2 billion per year in 1986 dollars for full compliance beginning in 1997. These costs are paid by the ratepayers and the economy of Indiana pays dearly in the loss of jobs and the higher prices for its goods and services.

Before any legislation is enacted, good business sense requires a cost/benefit analysis. We have seen no attempt to quantify the benefits expected from proposed legislation. Instead, we have seen the advent of a political movement to force certain segments of American industry, primarily the utilities in the Midwest, to undertake the costly program to add new emission control equipment, revise coal purchase programs and otherwise to incur increased costs for questionable overall benefit to the economy and to the environment.

In addition to the need for cost/benefit studies, there must be further opportunity for clean coal technology research to be carried out. And finally, we believe that all Indiana ratepayers would be among the hardest hit.

In the EEI study, increases for Indiana ratepayers were among the highest in the Nation. For Indiana ratepayers, and for Indiana industrial customers, the increase could amount to as much as 27.3 percent per year when the program is in full compliance status.

In the OTA study, the increase for Indiana industrials statewide could be as much as 37.2 percent per year.

Because of competition—particularly from imports—these increased costs cannot simply be passed along to customers.

There is further evidence that the industrial and commercial sectors will subsidize residential to a greater extent than under current rates.

Moreover, industrials who operate their own boilers will be required to conform to the emissions levels mandated on a State by State basis which could add millions of dollars more to the cost of doing business in the State of Indiana.

In summary, INDIEC recognizes that acid rain legislation will have a substantial cost impact on U.S. industry; (2) The acid rain problem requires a long term solution; (3) Industry must not pay twice for the same emission under acid rain legislation; (4) Federal and State responsibility when dealing with acid rain legislation must be very clear and concise. And finally, acid rain legislation is a national issue, and so the costs should be shared nationally.

The Indiana Industrial Energy Consumers strongly opposes legislation until such time as the scientific and cost information warrant such action.

I appreciate the opportunity to speak on behalf of INDIEC.

Thank you.

Mr. SHARP. Thank you, Mr. Good. We now welcome Mr. Vennon.

## STATEMENT OF EDWARD R. VENNON

Mr. VENNON. Thank you very much, Mr. Chairman.

Let me begin by welcoming our guests from New Mexico and Washington to Indiana—we are glad to have you—and those of you on the staff. We hope that you will find reason to come back to our State.

I am a trade association executive. And I think what I have to say to you today you will find to be parochial to and supportive of my members, and therefore, not shocking or surprising to you in any way.

I do have the honor, today, in addition to representing the Indiana Manufacturers Association, which employs me, to also represent our colleagues at the Indiana State Chamber of Commerce.

Speaking on behalf of both associations, which have 8,000 business members, I am very appreciative, Mr. Chairman, of the opportunity to speak on the issue of acid rain legislation, and the severe handicap that passage of the least offending legislation could place on future economic development in the State.

There is a united effort in the State on the part of labor and business, as you have had some indication of here today, to encourage defeat of H.R. 2666 and other principal acid deposition legislation pending in Congress which would cripple economic development, including business expansion as well as new industry, cause higher unemployment and increase the cost of electric energy for all Hoosiers to totally unacceptable levels.

Indiana was hit hard by the recession of the 1970's which caused some of the highest unemployment rates in the United States. It has taken years to recover and to begin to build a more diversified, more stable economy.

And I might add parenthetically here some statistics which I hope will indicate to you the perspective of what we have been battling in Indiana.

The recession of 1979 began at a time when Indiana's manufacturing employment as measured by jobs for which unemployment compensation taxes are paid to the State. Using that standard of measurement, we stood, in 1979, with a manufacturing employment base of approximately 739,000 jobs.

And you will all recall that the economists tell us the recovery from that recession began in December of 1962 (sic), some 4 or 5 plus years ago.

Manufacturing employment today in Indiana is 620,000. So, having disappeared someplace in that period of time from our manufacturing base of jobs in this State are some 110,000, 120,000 jobs.

Now, if you were to ask me what have we done to improve our productivity here, I would say we have done dramatically better than our loss of jobs would indicate. Our manufacturing work base here today is much more productive at 620,000, I suspect, although it is very hard to quantify that statistically, than we stood when we had 740,000 people in manufacturing jobs.

The acid rain bill proposed by Representative Sikorski poses a very real threat to the recovery that has gone on in Indiana and the viability of this State's economy. The drastic rate increases directly attributable to the bill would harm every business, individual and industry in this State. The electric rate structure which contributes to much toward Indiana's competitive business climate would vanish and so would business expansion with it.

I think you heard the Lieutenant Governor indicate to you how important competitive electric rates have been in the recovery that we have enjoyed.

Indiana's environmental agency, the Department of Environmental Management, says H.R. 2666 would cost Indiana utilities $2.5 billion in capital costs and you have heard the figure of the annual operating costs of about $205 million. And that is the more conservative of the pieces of legislation that are pending as we look at them.

This proposal, according to our State's estimates, would cause rate increases that would average as much as 15 percent or more. That kind of impact obviously hits everybody in the State including senior citizens on fixed incomes.

Manufacturing and mining would be the hardest hit. The Department of Environmental Management indicates that over 5,000 manufacturing jobs would be lost in the State and you can rest assured that the job losses would not stop there, there would be a ripple effect throughout the economy as electric rate increases boost the day to day cost of doing business in our State, leaving the State that much less attractive to prospective industrial clients.

The Department of Environmental Management also says 10,000 Indiana jobs would be lost under H.R. 2666. Unemployment would occur across the board in industries as diverse as food, apparel, paper, chemical, metal and machinery manufacturing. The National Association of Manufacturers estimates that implementation of

H.R. 2666 would cause a nationwide job loss in the area of 213,000. The effect of legislation in the Indiana coal mining community will be devastating, and you have heard some indication of that as well.

These remarks are not meant to sidestep any legitimate concerns about our ecological system. In 1980, recognizing the need to address whatever the acid rain problem might be, with the best available scientific resources, Congress established a 10-year National Acid Precipitation Assessment Program. The specific purpose was to investigate acid rain and its causes and effects.

A 1987 interim report by this body indicates that the Clean Air Act is, in fact, working and emissions sought to be controlled by the new legislation are already significantly declining.

The report concludes that there has been on health emergency connected with this source of pollution and that further increases of great consequence of acidification of waters and forests were unlikely under current restrictions.

It is apparent that this situation has developed more into a direct economic conflict with other parts of the country over factors having nothing to do with the environmental problem.

Western States are supporting the legislation in question under the presumption that Indiana utilities would be forced to purchase coal from their area. Southern States are licking their chops in the hopes that dramatically increased utility rates in Indiana would make their own economic climate more attractive to industrial development.

Neither is it clear what role the Canadian electric utilities are playing in the whole drama. But it must be reasonable to assume that significantly higher domestic utility rates might open the door for them to sell directly energy into the New England States area.

We believe the jury is still out on the true effects of acid rain. Often ignored is the fact that much of the effects of acid deposition are from naturally occurring sources. It is much more fashionable to put the blame on Midwestern utilities and industry.

The problem now is that Indiana citizens may be condemned by factors not even being brought into public discussion. That condemnation will cost thousands of Hoosier jobs, and the economic outlook for the State will be bleak, indeed.

We ask this committee, Mr. Chairman, to pass on to your colleagues in Washington our contention that an environmental crisis does not exist, and Congress should wait until the National Acid precipitation Assessment Program studies are completed and emerging new coal technologies have been developed.

Thank you for the opportunity to present our views.

Mr. SHARP. Thank you very much, Mr. Vennon. Let me recognize our colleagues for questions. The gentleman from Indiana, Mr. Coats.

Mr. COATS. Thank you, Mr. Chairman. Just one. Ms. Kress, I apologize for not being here when you gave your testimony. But I have read your submitted statement. And you present to the committee here some evidence of the effects of sulfur dioxide emissions, particularly effects on health. And I am wondering if you have those reports that you could submit to the committee.

Ms. KRESS. We will make them available.

Mr. Coats. All right. I would appreciate that, if you would do it. Thank you.

And Mr. Good and Mr. Vennon, I appreciate your restating, both of you restating the impact of the legislation, potential legislation that we are looking at, the impact on the State of Indiana, and bringing it to our attention from your various perspectives. And I think you give us all pause in terms of how we should proceed and what the proposed solutions ought to be to this issue that we are dealing with. And I thank you for that. And I know our time is somewhat limited, so I will pass on to my colleagues.

Mr. Sharp. Our colleague from Washington?

Mr. Swift. I just want to thank you all very much. It has been very helpful for me to come here and hear you and the other witnesses, and I very much appreciate the candor with which you have presented your case.

There is much that those of us who are not from the Midwest need to understand about that, to be sensitive to it.

But you can also be helpful if, as other ideas come up, you can evaluate them with an open mind. If something is going to pass, I would like it to be something you people honestly could live with rather than something that you simply cannot live with. And you are the ones ultimately, if you will be that flexible, you can help us find that point.

Mr. Sharp. The gentleman from New Mexico?

Mr. Richardson. Thank you, Mr. Chairman. I want Congressman Sharp's constituents to know that he is an extremely hardworking member of the House.

As you can see, we have not adjourned for lunch or any kind of break.

It is the same in Washington. That is how he squeezes every vote out of us. He will extend a number of hearings late into the afternoon. And I thought in his own home he would at least give us some time to eat. I am only—the point I am trying to make—we want lunch.

We have to leave at 2:30. And I want to thank Mr. Vennon for the nice words he said. Regrettably, my time in visiting your fine city will have to be at another time.

My question to Ms. Kress and Mr. Vennon and perhaps Chairman Sharp, as we have all talked about the effects on Indiana, on industry, on environmental groups, on users, on utilities, I wonder if any of your organizations, Ms. Kress, Mr. Vennon, Mr. Good—have you done any polling of what your citizens think? Have there been any scientific studies of the effects of acid rain legislation? I am sure you cannot frame it as the exact H.R. 2666. But is there any data in this State that shows what your citizens feel?

The reason I raise this is not because I am trying to please anybody here. But it would seem to me a State that has the most at stake, if you saw some spirit of compromise and trying to work things out, we have heard every extreme here. Obviously there is no consensus. And I wonder if maybe Mr. Vennon, or either one of you have done any polling.

Mr. Vennon. We have not, Mr. Richardson, done any polling, to my knowledge.

Let me ask some of my colleagues. Do we have anything back from the citizens of the State?

I suspect that if that does exist, it probably exists in the form of what normally might be referred to as political polls.

I suspect that those of you in public life have frankly been more sensitive, more attuned to the emergence of this debate that we are obviously involved in here, than perhaps we in the business community have been.

If we were to do one at the Manufacturer's Association, the individuals I would be polling would be the managers or chief executive officers at some 1,800 locations of about 1,400 companies. And I suggest to you, Representative Richardson, you and I both know what we would get back from that kind of a poll. You would get back something very similar to the statement which I have presented to you today.

On the other hand, what might we get if we polled Indiana's 5.2 million citizens? I do not know. Perhaps somebody with the capabilities at one of our universities perhaps could do that kind of public opinion poll and maybe we would all learn a lot more than we know today.

Mr. RICHARDSON. Well, I might suggest that you are a leader in the business community, Ms. Kress. Maybe some university could do this, in an effort to try to bring consensus. Because I would hate to take a vote on this issue right now having heard what I have heard today, the tremendous poles apart. It is the same in Washington. Do not feel bad.

But you folks here have probably more at stake than anybody else.

Mr. VENNON. Let me say this to you. I was an association executive in Lake County, Indiana in the mid-1970's when the first effects of the air pollution legislation and then the water pollution legislation were felt by the steel industry.

And I feel much more comfortable having a committee of Congress come to the capital city and tell us that the time may be drawing more when a compromise between ourselves and those on the other side of this issue may be forced upon us. Because that did not happen in the early 1970's and I dealt up there with the fallout of Congress having acted in a very, very positive way, followed by the immense amount of regulation that came down. And in many cases, people there in the industries that I worked for, attempting to deal technologically, without a solution, with a mandate, a public policy mandate of our U.S. Government, was a very difficult thing.

I would not want that to happen again over the present issue of acid rain. And I think I can say to you definitely on behalf of the Manufacturing Association, we have a technically competent environmental committee to deal with whatever proposals are debated in the Federal Congress; and through Representative Sharp and Representative Coats, and others serving there, we will make our views known. And hopefully, if a compromise is to be forged in the next year or so or three or whenever it happens, our voice will be heard.

Mr. RICHARDSON. Ms. Kress, Mr. Good, would you like to comment?

Mr. Good. I think I echo Mr. Vennon's comments. I think that in many respects, that acid rain, while it may have been an issue that has been around a long time, I think there are an awful lot of people that simply do not know what it is all about. And I think that probably one thing that needs to be done is certainly an education on all the various aspects. You know, what acid rain is really all about is, I think, in many cases, an emotional issue more than anything else. And so I think that this is something that certainly you gentlemen can be very forceful in getting those facts out to the public.

Ms. Kress. In reference to a poll, we have not polled anyone in Indiana. But I know a couple years back, the National Wildlife Federation did a poll through one of its magazines on what kinds of issues were important to people who were in their readership. I am not certain that one of those was not clean air. But I can find out. Whether or not those responses can be broken down to Indiana, which is doubtful, I can find out.

As far as the terminology, on the other side of the fence, or being at odds, I do not think it is a fair assumption or assessment to look at Indiana or the National Wildlife Federation as necessarily being in that particular posture with business and industry. Our president of the National Wildlife Federation in fact heads the Corporate Conservation Council. It was his idea to begin with. We strive to work with business and industry. Conservationists do not have their livelihoods in spite of business and industry. It is because of them. And we do see and wish to work with business and industry. There is a compromise, we are sure, that can be worked out, and we are willing to sit down and talk.

Mr. Swift. Would the gentleman yield?

Mr. Richardson. Yes, I yield.

Mr. Swift. I just noticed they were taking a little poll out here in the corner when I arrived—if you are for clean air, honk. And clean air was ranking right up there with Jesus. But no one is against clean air. And polling is difficult. Because to give a rational answer, you need to get a lot more information than that. And we have the problem of not being able to quite know what our constituents think if they understood as much about it as we do. But it was doing well on the street corner today.

Thank you for yielding.

Mr. Sharp. Thank you. I appreciate your attention to this.

Mr. Good, I think you raise a legitimate and real point of the need for both those on the committee, a deeper understanding of both the scientific basis as well as the impacts of proposed regulatory possibilities, and for the general public. And part of the reason of course of having a hearing is not only to educate us to the divergent opinions here in the State but hopefully to generate in the State more attention to and focus on what people care about in terms of their values and the emphasis they would place on just how much they will pay. General polling almost always comes up with the proposition that people are willing to pay for a healthier air and water. The harder proposition always to get at is how much, and how great do they think the risk is. And therein lies the nub of finding a better assessment of how far the values carry us.

But certainly our goal here is to try to both generate here at home a deeper recognition of what I think Mr. Swift has articulated very honestly and candidly with us, and others would do it more brutally, that there will be a decision made.

It is not clear to me it necessarily will happen this year, though that honestly can happen, and I think everybody should understand that that remains a significant possibility. I think the likelihood, my own assumption is the likelihood is greater that it will happen in the next Congress.

But I think that I was delighted to hear Mr. Vennon say and as I think you are trying to, Mr. Good, that you recognize that the interests of our State will best be served if when that decision is made, people are ready to talk seriously about the mechanics, the specifics and in hopes that we can in a sense get the best arrangement in terms of costs and the most control for the least cost, the most reduction in emissions for the least cost and not be in a position where because—and I as a legislator can face this, because if we are in total opposition, we may not be in the room where anybody is talking about the issue.

They may just say well, no sense in talking to those folks, they are going to be against everything anyway and therefore we will go make the new national law and let them pay the price. And that is just one of the tough, hard legislative and political realities that I know many in this room are familiar with here in the State if not in the Nation's capital.

And so we are trying to take, and I know my colleague, Mr. Coats is, take very seriously the substantive argument that is very intense about this, but also, the practical political realities of where we sit in the national legislature and in the Nation, and the drive that is very strong and very clear, coming both inside our country and outside our country, in terms of action and we want to be ready when the action comes to at least do the best job we can in getting the best arrangement for Indiana. That is our parochial interest.

And I really want to say thanks to our colleague from Washington, colleague from New Mexico who undoubtedly have plenty of things in their own State as well as in Washington that they might have been doing and they were kind enough to take the time to come here and hear and join in the discussion.

I think it has been extremely helpful to me and I trust to those in our audience that have been here as well.

Thank you very much.

Mr. COATS. Mr. Chairman, I neglected to offer the statement of Senator Lugar that was handed to me just a little bit ago.

So with unanimous consent, I would like to make that a part of the record.

Mr. SHARP. We will certainly make that a part of our record.

[Senator Lugar's statement follows.]

## STATEMENT OF HON. RICHARD G. LUGAR, A U.S. SENATOR FROM THE STATE OF INDIANA

Mr. Chairman, and Members of the Committee: I welcome the constructive efforts of your subcommittee to obtain the views of Hoosiers on acid rain and to assess the economic impact of pending acid rain proposals. I noted with interest your subcommittee's previous hearings on the scientific evidence on acid rain and the contribution that energy conservation can make toward solving the acid rain problem.

At the first of your oversight hearings on acid rain, Dr. Ellis Cowling, representing the National Academy of Sciences, made the important point that acid rain must be viewed in the context of the broader problems of the effects of air pollution. These effects include human health; damage to buildings and materials; degradation of visibility; acidification of lakes, streams and soils; and effects on crops and forests. Dr. Cowling pointed out that the pollutants that cause these effects are often interrelated. For example, to reduce acid rain, one must reduce sulfur dioxide, nitrogen oxides and volatile organic compounds. But nitrogen oxide and volatile organic compounds are also involved in the ozone problem and sulfur dioxide is involved in all of these effects. Dr. Cowling testified on the general need to reduce air pollution. He did not specify a precise amount of reduction or a firm time frame, but he did indicate that significant reductions in air pollution would be beneficial to human health and the environment.

I share this general perspective on the acid rain problem. I believe that it should be treated as part of the national need to reduce air pollution. If we put aside regional bickering, I think we can strengthen the Clean Air Act in a manner which is beneficial both to our environment and our economy. However, I cannot endorse the legislative proposals that have been introduced so far, such as S. 1894 (the Senate Environment Committee bill) or H.R. 2666.

The Senate Bill, S. 1894, would require sulfur dioxide emissions in Indiana to be reduced by 85 percent. This is far greater than any reductions which have been mandated in West Germany, or in any province of Canada. And these are countries in which acid rain is widely perceived to be an environmental crisis. An 85 percent reduction far exceeds any documented contributions that emissions in Indiana make to the acid rain problem and would have a major economic impact on the competitiveness of our industries and on the cost of electricity for all Hoosiers. The Congressional Research Service has concluded that S. 1894 would affect tens of thousands of jobs in coal mining areas of the Midwest and East. Major increases in electrical rates in Indiana and other States would also occur. The effects of H.R. 2666 would be similar, though not quite as extreme. These bills place far too heavy a burden on the economy of the Midwest.

One reason bills such as S. 1894 and H.R. 2666 have such a powerful economic impact on States such as Indiana is that they allocate emission reductions very unequally among States. Midwestern coal-fired powerplants are often portrayed as if they were virtually the sole source of acid rain problems in the Northeast. Yet excellent scientific testimony by Dr. Kenneth Rahn of the University of Rhode Island suggests that about half of the acidic deposition in the Northeast can be traced to oil-based rather to coal-based sources. Dr. Rahn suggests the desirability of uniform reductions by States in acid rain related emissions. We do not have adequate scientific evidence of the extent to which one State may contribute to acid rain problems in another State. But if each State reduces its acid rain related emissions by an equal percentage, we know that there will be an approximately equal percentage reduction in acid rain deposition in all States. It is, of course, in the Northeast that scientists have identified the greatest environmental problems stemming from acid rain. Bills such as H.R. 2666 and S. 1894, which allocate emissions reductions so heavily to the Midwest, will produce the greatest reductions where they may be the least needed.

While I strongly oppose measures such as S. 1894 and H.R. 2666, I think we must recognize the likelihood that revisions to the Clean Air Act—including measures to address the acid rain problem—will clear the legislative process at some point within the next 2 years. If we in the Midwest do not participate in this process, we run the risk that other States will pursue a "divide and conquer" strategy. When Clean Air legislation starts moving in Congress, we cannot sit back and denounce every proposal being offered as "too little, too late" or "too much, too soon." We will have to be prepared with reasonable proposals that protect our interests and address this problem in a fair and cost-effective manner.

What can we do to move toward a reasonable approach to the acid rain problem? I do not have a specific proposal of my own, but I do have a number of suggestions as to the manner in which one might be developed.

1. First, a technological approach to the problem is necessary. I believe that key to the solution to the acid rain problem is the use of clean coal technology. The high sulfur coal supplies of the eastern United States are a plentiful source of energy for the Nation. With clean coal technology, our supplies can be burned cleanly to the benefit of our environment and our economy. The use of coal washing and scrubbers is well established. But coal washing cannot achieve the reductions in acid rain

which are needed and scrubbers are sometimes too expensive (especially on older, smaller plants) or even technically infeasible (for lack of space at an existing plant). As a result, all studies of acid rain bills show that utilities would often switch to low sulfur coal rather than install technology controls to make acid rain reductions. This may help mitigate the effect on the consumer in individual cases, but what will be the effect on the price of low sulfur coal if it is widely practiced? Moreover, a fuel switching strategy would have severe impacts on the economies of coal mining areas of Indiana and other Midwestern and Eastern States. The only way to avoid these unacceptable economic and social impacts is through a technological approach.

2. A technological approach to acid rain control can be encouraged through the establishment of an acid rain "superfund" to provide appropriate incentives for a technology strategy rather than a fuel switching approach to reductions. Since it is anticipated that the lifetime of many coal-fired powerplants will be extended to perhaps as long as 60 years, a technological approach may be more economical in the long run than a switch to more expensive, low sulfur coal. But it will not come about unless it is encouraged by Federal law.

3. There is great promise in the development of new clean coal technology. In 1983, recognizing that Clean Air Act standards were likely to become increasingly stringent, I moved to establish a Federal program within EPA to demonstrate the LIMB system (Limestone Injection Multistage Burner) as a retrofit technology or coal-fired powerplants. If technically proven, LIMB should be readily available in the early 1990's. With LIMB, both sulfur and nitrogen oxides from existing plants could be reduced at least 50 percent at a capital cost far less than those of scrubbers.

In 1987, as a result of his meetings with Canadian Prime Minister Brian Mulroney, President Reagan launched a vigorous effort to demonstrate new Clean Coal technologies. Congress has already funded $925 million of the President's proposed $2.5 billion plan. Through this ambitious effort, a variety of new clean coal technologies can be developed that would reduce emissions to a greater degree than is possible with today's commercially available technologies. These include technologies that could be used not only for stricter pollution control but to "repower" existing plants to increase their efficiency. These technologies can also play an important role in the next generation of new powerplants. We must ensure that an acid rain reduction program does not dampen their development.

In summary, then, I urge your subcommittee to consider the following principles in formulating an acid rain reduction plan:

1. Allocate emission reductions more uniformly among the Northeast and Midwest, limiting reductions to those which are cost-effective. Recognize the scientific evidence that—because of distance factors—emissions in the Northeastern States although lower than in the Midwest—are as much a part of the acid rain problem in that region as are emissions from coal-fired powerplants.

2. Establish an acid rain "superfund" sufficient to provide the necessary incentives for a technological approach to the problem as a primary strategy. At the moment, there is no agreement on the means of financing such a fund. Governors Cuomo and Celeste have proposed the use of general revenues combined with what amounts to a 2 percent fee on oil imports. Senator Kerry has proposed the use of a fee of 0.5–1.6 mills per kilowatt hour on electrical generation. It took Congress a long time to agree upon a reasonable fee structure for the hazardous waste Superfund, but eventually we did so. There is no reason why we cannot do so in the acid rain situation.

3. Phase-in emissions reduction to mitigate economic impacts and to permit periodic assessment of the program.

4. Establish reasonable compliance deadlines that won't preclude the use of promising, new clean coal technologies.

The final resolution of the acid rain issue will probably differ substantially from any of the proposals which have been advanced so far. It will be a test of the workings of our Government. But with good will and common sense, I am convinced that we will be able to put aside regional conflicts and identify a reasonable approach to this important national problem.

Mr. COATS. And again, thank you for your efforts in pulling this together and to my colleagues for taking time out of an otherwise busy schedule to come to Indiana to hear our side of the story.

Thank you for your participation.

Mr. SHARP. Let me indicate again our record will be held open for written statements from other individuals and organizations within the State.

On the Federal level, we will have other hearings so folks outside of Indiana will get to testify. So our purpose here is to make sure that opportunity is here for Hoosiers.

And even some of our witnesses or people may, after various things they have heard, wish to respond in some specific way. And we will be delighted to have that information.

Thank you all for your time and attention to this. And with that, the hearing stands adjourned.

[Whereupon, at 1:30 p.m., the subcommittee was adjourned, to reconvene at the call of the Chair.]

[The following correspondence was received for the record:]

June 20, 1988

BUTLER UNIVERSITY

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4600 Sunset Avenue
Indianapolis, Indiana 46208
317-283-9421

Congressman Philip L. Sharp
U.S. Capital
2452 Rayburn House Office
Washington, D.C. 20515

Dear Congressman Sharp:

I am pleased to note that you are holding hearings in Indianapolis on the benefits and costs of measures to control acidic emissions. I regret not being able to be present to testify. Instead, I am summarizing my thoughts in a letter that could be distributed at the hearing and included in the record.

I have been making appearances and presenting testimony for fifteen years now on the risks of acidic emissions to our environment and economy, and, inevitably, find discouragement in the price we pay for no action. Let me briefly recapitulate the conclusions I reached at various times, and their outcomes:

- August, 1973: Testimony before the Wisconsin Public Service Commission, including a finding that the state should require controls for sulfur dioxide emissions from the power plants then being considered for construction, so as to avoid expensive retrofitting for emissions control that I thought would be required in ten years to protect Wisconsin's billion dollar recreational industry.

  *Outcome – Wisconsin mandated a fifty percent reduction in state-wide sulfur dioxide emissions in March, 1986 after accepting the increasing evidence that their recreational industry was at risk.*

- November–December, 1980: With other members of the U.S./Canada Work Group I, under the U.S./Canada Memorandum of Intent, a compromise consensus was reached that a target loading of 20 kilograms per hectare of $SO_4$ (wet deposition) would protect a majority, but not all, of the aquatic resources at risk in Canada and the northeastern United States, and should be adopted as part of the $SO_2$ regulatory program in the two countries.

  *Outcome – The U.S. government continues to find this target loading too strict, but independent studies have led the State of Minnesota to enforce a target loading of 11 kilograms per hectare there, and the*

*Wisconsin program will result in a loading of 14 kilograms per hectare; other states are now pursuing similar actions, each one gradually diminishing the market area for our midwest coal.*

- March, 1982 — The reports I prepared for Congress's Office of Technology Assessment included a finding that 3,000 lakes and 2,500 miles of streams in the eastern United States were already in an acid-altered state and at risk of further acidification.

- *Outcome – A multi-million dollar research program by the Environmental Protection Agency sought to challenge these estimates, and although definitions have changed somewhat, the count of lakes at risk is now even higher than our early estimate, and data released last week indicates 3,000 miles of stream in acid altered state, 20 percent higher than my findings of six years ago.*

- May, 1984 - In testimony before the Indianapolis Air Quality Board I summarized the evidence that indicates a likely 2 for 1 benefit to cost relationship for Indiana from measures (at mid-range cost) to control sulfur dioxide emissions in this state. This finding takes into account benefits from reducing damage to materials (i.e., lengthening replacement time for industrial materials and instruments), improved visibility and its potential for promoting clean air industries (such as recreational use of our lakes), a broad spectrum of health benefits (conservatively estimated), and benefits from restoring growth of forests and crops. No benefits were included for aquatic resources, as these will be mostly in the northeast U.S. or Canada.

  *Outcome – The elapsed time since this testimony is still insufficient to validate the findings, but recently, and for the first time, there is now widespread discussion of the benefits to Hoosiers from sulfur emission control programs in relation to the increase in electricity costs. My estimate of benefits here is no more remarkable than my finding in 1973 that Wisconsin would have to control $SO_2$ emissions, and I expect they will be verified over a similar time frame.*

The issue, of course, is not only whether these scientific assessments have been on target, but whether the narrowly drawn declarations opposing any increase in electricity costs have given adequate consideration to the high costs of doing business in the presence of the elevated acidic deposition in Indiana. In addition to the direct costs and benefits I summarized in 1984, there are the indirect costs from losing our coal markets as other states act unilaterally, (e.g., Wisconsin, and the prospect of others), and we pursue an image and business perspective that is out of step with the rest of the country, largely experiencing a more rapid economic recovery than we have.

Let me also say something about the unique opportunity that is afforded by having you, as a midwestern congressman, provide personal leadership in finding an accommodation among the diverse views on $SO_2$ and $NO_x$ control strategies. Essentially, the differences have narrowed now to, on the one hand, an industry view that we wait for new control technology so that we save in capital costs and in the loss of energy required to operate wet scrubbers. This technology could begin to be installed by 1995, and a program could be concluded at modest cost by the year 2005. This represents a seven-year further delay over the more aggressive control strategies that would reduce 12 million tons within the next ten years (utilizing wet scrubbers if we are to use our Indiana coal). The question, therefore, is not really the magnitude of the benefits to be expected from emissions controls eventually, but the magnitude of the benefits from action now versus action delayed up to seven years. Surely this gap is negotiable now!

Let me emphasize that I am greatly concerned by the additional damage that will accrue from the seven year delay, but I am also concerned about the waste in energy and the further emissions of carbon dioxide (a greenhouse gas) that goes with the inefficiencies of wet scrubber technology. I ask that you pursue any compromise that would combine early action where it can be achieved without wet scrubbers, and new technology within the earliest possible timetable to retain the utilization of midwestern coal, a battle we are losing in the absence of federal legislation.

Here in Indiana, I believe a broad spectrum of our community wants a settlement of this divisive issue. The unions need to know that steps are being taken to assure continuity in coal mining in Indiana, and want the uncertainty put behind them. The electrical utility industry also is facing major uncertainties in maintenance and upgrading programs due to the fact that legislation continues to stand pending. Although they may not like a compromise, there are advantages to getting the decisions behind them. Perhaps even the legislative community, after almost ten years of debate on acid emission control strategies, may now be ready to get this behind and turn to other important matters.

Therefore, Congressman, I ask again that you use your reputation as a respected midwestern congressional leader, capable of looking at both sides of the tradeoffs involved, and push aggressively to find a solution to the "seven-year difference." We need legislation this summer and fall with bipartisan and multi-constituency support. I wish you good luck on it.

Sincerely,

Orie Loucks

Orie L. Loucks

OLL/sc

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June 20, 1988

Congressman Henry Waxman
Congressman Philip Sharp
Energy and Power Subcommittee
Energy and Commerce Committee
Washington, D.C. 20515

Dear Congressmen Waxman and Sharp:

Due to time constraints I am unable to testify this year at your field hearing on acid rain and the Clean Air Act reauthorization at Indianapolis this date. With this letter, I want to briefly summarize the benefits which I believe will accrue both to Indiana and the nation from a significant reduction of sulfur dioxide/nitrogen oxide, sulfates, nitrates and acids commonly accepted now as embodied within acid rain and air pollution.

Let me please preface my remarks by mentioning my previous testimony given to the Committee on February 10, 1984 here in Indianapolis which would be the same today, four(4) years later, except for the bill numbers which have changed and the nature of putting more cleanup upon the polluters. I attach hereto Exhibit 1 which are those remarks.

Secondly, I want you to be aware that after the hearings here in 1984, I became a member of the Democratic National Platform Committee until just this past week and with my caucas chairmen Michael Dukakais and then Congressman Tim Wirth led the effort which succeeded in the 1984 Democratic National Convention adopting the strongest possible planks on all forms of pollution of our environment including this one on acid rain: (found at p. 25)

> " The Democratic Party calls for an immediate program to reduce sulfur dioxide emissions by 50% from 1980 levels within the next decade; this program shall include interim reductions within five years of its enactment. In addition, significant progress will be made to further reductions of nitrogen oxide emissions. Our effort should be designed to reduce environmental and economic damage from acid rain while assuring such efforts do not cause regional economic dislocations. Every effort should be made to mitigate any job losses associated with any national acid rain program. "

I am sorry to say that, as you know, nothing has been done to activate this policy of the Democratic Party.

## WHAT SHOULD A "PERFECT CLEAN AIR BILL" CONTAIN

Michael A. Feldman, an attorney in Miami, Florida and award winning writer, wrote in the December, 1987 issue of Trial magazine of an optimal Clean Air bill. Below described are some of those provisions which make sense to me. I attach as Exhibit 2 his complete writing entitled Acid-Rain Legislation.

Mr. Feldman and I both advocate:

1. That Congress must provide in the Clean Air Act secondary National Ambient Air Quality Standards (NAAQS) for general welfare of the environment with the same enforcement mechanisms as the primary NAAQS to protect such things as lakes, forests, etc. along with the primary standards set to protect basic human health with a margin of safety. An enforced NAAQS for both primary and secondary standards would more effectively control air pollution of all effects and give the EPA the teeth in the law it should have to enforce its powers protecting actual human health and welfare injuries inflicted by various pollutants like acid rain, urban smog and toxic pollutants generally.

2. That Congress should carefully evaluate whether its provisions cutting off federal aid for cities and towns which do not conform to the Clean Air Act is actually counterproductive to the reauthorization of the Clean Air Act as it creates a political entanglement and backlash against clean air and the philosophy that a clean environment and a growing economy go hand in hand. It does not really deter pollution as it does not make the actual polluter pay for anything.

3. That Congress should work toward a statute which spreads the cost of the clean up of the air across the nation so that everyperson, whether in a so-called generator state or in a receptor state pays a share to clean up his or her national air quality. Even those states which receive the dirty air from other states do generate some pollution of the air from their own local sources. The air pollution effects our national forests, our oceans and our national parks. Who can say he is not affected by a cleaner environment?

4. That Congress should provide a mechanism for emissions trading in the so-called bubble, but with tighter controls on the specific area and close monitoring to make certain the worst area is cleaned up first if at all possible.

5. That the Congress should not and can not encourage fuel switching without grave consequences to the very areas that are having to clean themselves up. Job losses, industry lay offs and abandoned resources like high sulfur coal will prevent consensus on Clean Air and acid rain. Thus, there needs to be in this reauthorization of the Clean Air Act provisions for subsidies to the states to clean up their sources of air pollution and to then be able to more readily use those resources in the decades ahead.

6. That the Congress must fund this subsidy in the Clean Air Act by a national tax on generation of electrical power. A small fee of .3 cents on each kilowatt hour of fossil fuel generated in 31 states will increase utility rates less than seven (7) per cent according to federal studies documented in the Feldman report. By

including all states, this figure would come down. Also, as an alternative, using a system of this electricity use tax but with credits and debits for utilities based upon the amount of sulfur dioxides emitted would reward or punish those who have or have not tried to clean up their emissions. Utilities ought to be likely to support that.

7. That the Clean Air Act must also require that the Prevention of Significant Deterioration program (PSD) be interpreted to include interstate areas which the present law does not allow.

8. That EPA must be mandated to deem sulfates, nitrates, and nitric and sulfuric acids as "criteria pollutants" under the Clean Air Act, and primary NAAQS's.

IT IS THIS WRITER'S OPINION THAT THE ABOVE SUGGESTIONS ARE MINIMAL FOR INDIANA TO ACCEPT OR ELSE INDIANA WILL GET A MUCH WORSE DEAL WHEN THE "ACID RAIN TRAIN" FINALLY DEPARTS. THE MIDWEST SIMPLY CANNOT OUTVOTE AND OUTMANOEUVRE THE REST OF AMERICA FOREVER.

## RECENT CELESTE-CUOMO PROPOSAL

This month Governor Richard Celeste and Governor Mario Cuomo of the states of Ohio and New York respectively have provided a new proposal to combat acid rain and air pollution. Attached hereto as Exhibit 3 are news articles sketching the plan to clean up. The Plan would raise $1.8 million dollars per year from the oil industry, from the federal budget and from the polluting industries and sources to finance the cleaning. Because the plan discourages coal-switching and seeks to protect jobs and economic growth, it must be examined very carefully and especially by Indiana's Congressmen, state officals, industry, environmentalists and the general population who breathe air.

## CONCLUSION

Four(4) years ago, this Committee or one in its stead took evidence on these matters here and elsewhere. Congress must now make decisions to solve these urgent national problems to clean the air, protect jobs, create new jobs, hold utility rates down and make the polluters pay their fair share.

There is virtual unanamous backing for the proposition that Acid Rain and our air pollution exists, does damage and is out of control. Acid Rain, Urban Smog, Ozone, and Toxic Air Pollutants will surely not destroy a concerned America with pressures applied to its leaders to act now or forever suffer the consequences.

Gregory K. Silver
Gregory K. Silver
Legal Counsel, Sierra Club
Hoosier Chapter

# Acid-Rain Legislation

## Cleaning Up Legal Fallout

*Michael A. Feldman*

***Although the Clean Air Act was amended to take note of the fact that winds shift air pollution and acid rain from one jurisdiction to another, it is inadequate to cope with transjurisdictional acid precipitation and its consequence, legal fallout, says the author. Congress can solve this problem by enacting specific acid-rain legislation.***

Over the past 40 years, there has been a tripling of emissions of sulfur and nitrogen oxides in the United States.[1] Moisture converts sulfur dioxide into sulfates and sulfuric acid and nitrogen oxides into nitrates and nitric acid. These are deposited as acidic gas, fog, dew, mist, rain, hail, frost, snow, sleet, dust, and particles—referred to collectively as acid rain,[2] about 20 percent of which is caused by smokestack industries and 67 percent by electrical power plants.[3]

There is a direct link between sulfur-dioxide emissions by industry and the death of aquatic life in lakes and streams in the United States and Canada.[4] Acid rain also destroys commercially valuable trees.[5]

In the 1970s, the public and government in Germany were unimpressed by barely visible forest decline. In 1982 and 1983, damage quadrupled to 34 percent of all German forests.[6] If Canada suffers such damage, the Canadians will blame the United States, which causes half the acid precipitation in Canada.[7] Even without such a catastrophe, acid rain will continue to be what the Canadian Ambassador has called a "serious irritant" to U.S.-Canadian relations.[8] There is also a danger of internal confrontations; up to 80 percent of acid rain in the U.S. Northeast has been traced to sources in the Midwest.[9]

The Environmental Protection Agency (EPA) estimates that sulfur-dioxide emissions are responsible for health costs of $17 billion a year in the United States.[10] Acid rain also makes water corrosive. Corrosive water leaches metals from whatever it contacts, like aluminum from soils and lead from pipes. High concentrations of aluminum in drinking water increase the incidence of Alzheimer's disease.[11] Lead in drinking water has caused hypertension in adult males and has decreased scores on intelligence tests of children.[12]

Sulfur dioxide erodes paint, metals, and building stone, which aggravates air-pollution damage to property at a cost of $2 billion to $4 billion annually in the United States.[13] Eliminating half of all such emissions would cost polluters an estimated $4 billion annually.[14]

Under § 108 of the Clean Air Act, sulfur and nitrogen oxides are "criteria pollutants" because the EPA has determined that they have an adverse effect on health or welfare and are caused by many sources.[15] Section 109 requires the EPA to set the primary National Ambient Air Quality Standard (NAAQS) for sulfur and nitrogen oxides to "protect the public health" with "an adequate margin of safety," and a secondary NAAQS to protect public "welfare" like lakes, forests, and man-made materials.[16] Section 110 directs each state to submit to the EPA for approval a State Implementation Plan (SIP) that specifies maximum emissions for each source within the state and states how the SIP will achieve the NAAQS.[17] If the EPA does not approve a SIP, it can withhold federal funds or implement its own plan.[18]

Although a primary NAAQS has been set for sulfur and nitrogen oxides,[19] it has not been set for sulfates, nitrates, or nitric or sulfuric acid because the EPA has not classified these as "criteria pollutants." If studies on the health effects of sulfate and nitrate particulates are funded and the EPA finds it politically expedient to deem such particulates "criteria pollutants," the EPA could promulgate a more specific NAAQS. But an enforceable NAAQS, based on the actual health and welfare injuries inflicted by all of these related pollutants, cannot be promulgated unless Congress provides the secondary NAAQS with the same enforcement mechanism as the primary NAAQS.

The enforcement mechanism for a primary NAAQS cannot even prevent immediate health hazards near the source of pollution. Since the EPA could not achieve the NAAQS locally, it disapproved the SIP presented by Ohio, which emits more sulfur dioxide than any other U.S. state.[20] Ohio continues to pollute because the EPA found that implementation of an alternate EPA plan was complicated and overtaxed EPA resources.[21]

Because the EPA was unable to coerce states like Ohio to comply with the NAAQS, in 1977 Congress provided the EPA with the power to terminate federal funding for state highways and sewage treatment plants and to prohibit construction of new maor stationary sources. The EPA, states, industry, and environmentalists, however, soon recognized that terminating or banning construction is politically unwieldy. The EPA is concerned with preventing political backlash against the federal government, and environmentalists are interested in precluding opposition to the strengthened Act. Therefore, since 1977, a "bizarre conspiracy" has existed between the EPA and environmentalists not to impose the 1977 amendment sanctions on states.[22]

Some states can only comply with a NAAQS by encouraging sources to disperse their emissions of sulfur and nitrogen oxides, which drift into other states as gases, transformed and unregulated sulfates and nitrates, and acid rain. This problem was partially solved by the 1977 amendments to §

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111, which require new plants to reduce uncontrolled sulfur-dioxide emissions 70 to 90 percent[23] regardless of the local air quality.[24] The New Source Performance Standards (NSPS) save states the expense of having to offer more relaxed standards to industry because, unlike a NAAQS, NSPS are nationwide and source-specific.[25]

Unfortunately, NSPS do not apply to existing plants, and older plants have remained in use[26] because they are cheaper to operate and can be replaced piece by piece and because the cost of new construction has skyrocketed.[27] Plants built before 1971, when the first federal emissions regulations were issued, will still account for more than 90 percent of total utility sulfur-dioxide discharges in 1995.[28] In fact, U.S. sulfur-dioxide emissions are not expected to decrease before the year 2000.[29] Existing smokestacks may continue to spread pollution across state and national boundaries for another 40 years.[30]

## Finding a Solution

The solution lies with federal legislation. Since the Clean Air Act is inadequate and conventional legislation has lacked sufficient support, legislators should take a different approach. Enforcement of punitive regulations now requires time-consuming and expensive litigation. Current punitive regulations do not deter corporate pollution because the cost to the polluter is modest. Moreover, government subsidies or special tax incentives tend to encourage inefficient retrofitting.[31]

New legislation must do more than replace the current legal fallout caused by pollution with political fallout from the disproportionate economic impact of the statute. Since it is not politically feasible to compel polluting states and industry to implement long-term emissions-reduction systems, legislation purporting to alter the current economic impact will fail or will at best be watered down until it constitutes another inadequate amending of the Clean Air Act.

Representatives from the Northeast and other injured areas should concede that they must make short-term economic sacrifices to preserve long-term resources. It would be prudent for citizens of injured states of the

Northeast, for example, to pay $2 billion annually to help reduce acid rain from other states that causes more than $5 billion of damage annually. Therefore, the optimal statute would reduce opposition from midwesterners and polluters by making beneficiaries pay part of the cost of reducing emissions.

The EPA has experimented with emissions trading through its policy of placing an imaginary bubble over a plant with multiple points of air pollution. While cumulative emissions within the imaginary bubble are fixed by regulation, the plant can vary controls among different emission points. Thus, a plant can control emissions at a point where it is less costly and forego more expensive controls elsewhere. Acid-rain legislation should not merely reauthorize but should require the EPA to permit emissions trading, provided that it is monitored and that trading rules are tightened to reduce abuses.[32]

The costs of mitigating emissions are not linear. The traditional approach, in which the polluter pays for and chooses the emissions-reduction technique, would cost polluters about $270 per ton of sulfur dioxide abated where 8 million tons are abated from 1980 levels, $360 per ton where 10 million tons are abated, and $779 where 12 million tons are abated. Costs would rise at higher levels of abatement because technology would have to supplant switching to low-sulfur coal.[33]

It costs less to switch to low-sulfur coal than to install equipment to reduce emissions.[34] The optimal acid-rain statute, however, would not encourage fuel-switching, because lowered demand for high-sulfur coal would exacerbate unemployment for mining communities.[35]

The cost of installing pollution-control equipment can be subsidized. The funds for such subsidies can be derived from fees on the generation of electrical power, which would accumulate in an interest-earning fund. The Congressional Research Service estimates that a fee of 0.3 cents on each kilowatt-hour of fossil-fuel-generated power in 31 states would increase rates less than 7 percent.[36]

A variation on the trust-fund approach is the hybrid emissions-generation fee, which would be assessed not only by consumption but also by the quality of pollutants emitted per kilowatt.[37] The hybrid fee should encounter less opposition from "clean" utilities than the simple generation fee. Since the hybrid fee would require the government to monitor sources and would yield unstable income, however, it would be administratively complex.[38] Moreover, both approaches tax utilities but not other polluters.

Senate Bill 95,[39] introduced by Senator John Kerry in the 100th Congress, would impose a fee on electricity generated by fossil fuel based on the average sulfur-dioxide emission rate of each state in pounds per million BTUs of heat input. These fees would be deposited into a fund, from which the EPA Administrator would pay plant owners $147 per ton of sulfur dioxide reduced. Up to $10 million per year is also to be paid for research of cleaner industrial processes.[40]

Because S.95 would tax polluting states the highest, it will be opposed by Midwestern states and by utilities that generate electricity with fossil fuel. Nonetheless, some of its provisions could be incorporated into the optimal acid-rain statute. Since the S.95 subsidy program does not directly subsidize the rates charged to consumers, it might avoid the need for rate-setting activities, which result in conflicting standards, delays, and conflicts with state limits on gubernatorial power.

S.95 would go beyond funding research by encouraging polluters to install cleaner, commercially proven technology. This is not a radical suggestion. The 1977 amendments authorized the Prevention of Significant Deterioration (PSD) program, in which new sources in designated regions must include the "best available control technology."[41] Unfortunately, the EPA has determined such technology to be "flue-gas desulfurization,"[42] in which lime and water are sprayed through the escaping gases. In a typical plant, such smokestack "scrubbers" produce hundreds of thousands of tons of potentially toxic sludge.[43]

More efficient coal-desulfurization technologies, including chemical, microwave, electron beam, liquefaction, and underground gasification are close to feasibility.[44] The Electric Power Institute sees its Cool Water Coal Gasification Program, a full-scale

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The optimal statute would also address the deficiencies inherent in the Clean Air Act. Courts have held that PSD new source requirements need not consider clean-air regions in another state.[46] This should be amended.

Acid-rain legislation should enforce a secondary "welfare" NAAQS with the same mechanism as a primary "health" NAAQS. This will force the EPA to consider total harm inflicted when it sets NAAQS. Moreover, the EPA should deem sulfates, nitrates, nitric and sulfuric acids to be criteria pollutants requiring a NAAQS.

Sanctions should enforce nationwide source-specific standards to preclude industry from "shopping" among states and prevent states from competing through SIPs that offer more lenient standards.

The simplest sanction would be a tax per unit of pollution emitted, which would put continuous pressure on polluters. A variation would be to exempt a base amount of emissions, but this would not encourage polluters to reduce emissions below the base. An alternative system, which would take the best account of local conditions, would be to require polluters to "buy" the right to pollute.[47]

Due to the high, concentrated costs of the "polluter pays" approach, utilities and Midwestern states would oppose such an approach. The most politically acceptable and cost-efficient statute would both tax emissions and subsidize the costs of reducing emissions. For example, a statute that taxed pre-NSPS sources $600 per ton of sulfur dioxide emitted and used that tax to subsidize pollution-control efforts (90 percent of capital and 50 percent of annual operations and maintenance costs) would reduce sulfur-dioxide emissions from 1980 levels by 9.6 tons, losing only 8,500 mining jobs in the four most affected states—Ohio, Indiana, Illinois, and Pennsylvania—by 1995. The Congressional Budget Office (CBO) estimates costs at $45.9 billion (discounted 1985) from 1986 to 2015.[48]

Although the immediate costs of such a tax statute are higher than a statute that merely imposes emissions ceilings, the tax statute encourages utilities to reduce emissions immediately and achieves earlier emissions control and prompt acid-rain abatement.

## Conclusion

The optimal acid-rain statute for the 100th Congress is one that would have broad appeal in both Houses. The United States needs legislation now. Time is of the essence because the health, economic, diplomatic, political, and environmental hazards of acid rain are increasing under the Clean Air Act. ■

# Cuomo and Governor of Ohio Join in Proposal on Acid Rain

6/6/88
NY Times

By PHILIP SHABECOFF
Special to The New York Times

WASHINGTON, June 5 — The Governors of New York and Ohio, two states that have been on opposite sides of a fierce debate over reducing acid rain, have agreed on a joint proposal to require steep reductions nationwide in pollution from coal-fired power plants and other industrial sources over the next 25 years.

The proposal for new Federal acid rain legislation, which could represent a breakthrough in a long deadlock in Congress, was reached after a year of negotiations between Governor Cuomo and Gov. Richard Celeste of Ohio, assisted by their aides.

The agreement would raise about $900 million a year to pay about half the anticipated cost of compliance and to help the polluting states meet the anti-pollution goals. More than two-thirds of the $900 million would be paid by the oil industry, the other third by the Federal Government. An additional $900 million would be paid for by polluters.

The proposal differs in several key respects from legislation now pending in Congress, legislation that is backed by states that suffer from acid rain pollution and opposed by states where much of the pollution originates. Leading each side of the battle over that legislation have been lawmakers from New York, one of the biggest victims of the pollution, and Ohio, where plants emit more sulfur dioxide, a major source of acid rain, than any other state in the country.

Compared with the pending legislation, the new compromise would require a smaller reduction in the pollutants that produce acid rain. It lengthens the period for reaching the anti-pollution goals, and it provides innovative techniques for sharing the costs of compliance with the program by the whole nation, including o device for providing revenue from an expanded Strategic Petroleum Reserve.

### Cuomo Vows a 'Push'

Governors Cuomo and Celeste said in telephone interviews over the weekend that they would ask members of Congress from their respective states to introduce their proposal as amendments to the Clean Air Act. They also expressed the hope that an agreement between two large states at opposite poles of the issue would clear the way for a breakthrough on the impasse on controls that has persisted for nearly a decade.

Governor Cuomo called the agreement "a reasonable and imaginative effort to resolve our differences and solve the problem of acid rain." He said he would "push hard and will keep pushing" to achieve a national program to deal with the issue.

Hundreds of lakes in the Adirondack Mountains in New York have become acidified by the pollution, much of

Continued on *Page 11, Column 1*

# Cuomo and Celeste of Ohio Offer Acid Rain Plan

*Continued From Page 1*

which is believed to come from coal-fired electric power plants in Midwestern states such as Ohio.

Ohio and other Midwestern states with large coal-fired power plants have opposed acid rain controls because they feared that such a program would lead to sharply higher electric rates and to a loss of jobs in mining industries that produce a great deal of coal with a high sulfur content.

Governor Celeste said today that "if the folks in New York and Ohio can find a common ground, it may well serve as a guidepost for the rest of the nation."

New York's two Senators, Democrat Daniel Patrick Moynihan and Republican Alfonse D'Amato, praised the agreement and said they would introduce legislation to implement the proposal.

### Governors Wanted Settlement

Governor Celeste said today the more strict legislation pending in Congress was like a "sword of Damocles" hanging over electric utilities and other industry in Ohio because it would impose a heavy cost. He also sought a settlement because many companies in his state have held off on long-range investment plans because of the

Governor Cuomo, who has long sought strong legislation that would reduce acid rain damage to New York, is willing to accept a program somewhat less stringent than pending legislation, that would take longer to implment and that would cost New Yorkers more because the program has a better chance of being adopted.

Among acid rain legislation already in Congress, the most prominent was introduced by Senator George Mitchell of Maine. The legislation has wide support but also serious opposition, including that of the majority leader, Senator Robert Byrd of West Virginia. Mr. Byrd considers the Mitchell legislation, which would require businesses to pay the cost of acid rain control, a threat to his state's coal industry. Its chances are considered questionable.

> The program would cost $1.8 billion a year for 10 years.

Mr. Mitchell today said he would have to examine the New York-Ohio bill to see whether it was fair and sufficient, but he called the proposal "encouraging," and commended Governor Celeste for what he said was "political courage." He said that the proposal should help get a bill enacted this year.

Acid rain is caused by pollution from power plants and other industries that produce oxides of sulfur and nitrogen. These change chemically as they travel through the atmosphere and descend as acid rain, snow, fog or dust. Much of the pollution blows into the Northeast and Canada on winds from the Midwest's industrial areas.

### Environmental Damage

Scientists generally agree that acid rain destroys plant and animal life in sensitive lakes and streams, and some scientists believe it damages forests and man-made structures, adds to the pollution pressures on marine life in eastern coastal areas, threatens human health in many areas.

Years of efforts by Eastern states and the Canadian Government to reduce acid rain have been unsuccessful. They have been opposed by polluting states and by the Reagan Administration on the ground that billions of dollars would be spent with too little information about acid rain's effects and the impact of controls on electric rates aod coal-mining jobs. The result has been a deadlock on Capitol Hill.

The plan proposed by New York and Ohio to break this deadlock would require reductions of sulfur and nitrogen emissions by polluting states in several stages between now and 2003. Total sulfur dioxide emissions would be reduced in three phases by a national total of 10 million tons from the current level of about 23 million tons a year. All of the reductions would be made by coal-fired utility plants.

According to Thomas C. Jorling, head of New York's Department of Environmental Conservation, the major sources of Midwestern pollution would have to make the biggest reductions in the first stage of the program, which would end in five years.

The plan would also require a 3 million- ton reduction in nitrogen oxide pollution by 1998 from current emissions of nearly 20 million tons a year.

### $1.8 Billion a Year

The proposal anticipates that the plan would cost $1.8 billion a year nationwide to carry out in the first 10 years.

Under the proposal, the Federal Government would provide $900 million a year in subsidies. Of that, $650 million a year would come from a major change in the way the nation pays for the Strategic Petroleum Reserve.

The reserve, which consists of oil that is under storage for use in the event of a national emergency, is now paid for with Federal tax revenues. Under the New York-Ohio proposal, the pace of filling the reserve would be accelerated and the cost would be shifted from the Treasury to the oil companies, which would be required to set aside 2 percent of their imports for that purpose. The companies would retain title to the reserve oil and would paid storage fees, from which would come the $650 million to help subsidize the acid rain program.

According to the state officials who prepared the plan, the cost of filling the reserve and storing the oil would be passed on to consumers at the gas pump and would amount to about 1 cent a gallon, or $7 a year for the average New Yorker.

R. G. Ensz, a spokesman for the American Petroleum Institute, which represents major oil companies, said that the oil industry had not yet seen the proposal and could not comment on it. But he added that the plan for the Strategic Petroleum Reserve "seems very complex."

The proposal also calls for the spending of $2.5 billion by the Federal Government over a 10-year period, to help develop technology to burn coal cleanly. President Reagan has introduced a five-year clean-coal program, involving the same amount of money. But in his program, money can be used for other purposes, such as developing synthetic fuels from coal.

The New York-Ohio plan requires that all of the Federal money be spent on pollution control equipment and provides no money to enable plants to switch from coal with high sulfur content to coal with low sulfur content. This provision is intended to protect the jobs of miners in Ohio and other high sulfur coal areas.

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Sr Utley 7/15

July 6, 1988

The Honorable Philip R. Sharp, Chairman
U.S. House of Representatives
Subcommittee on Energy & Power
2452 Rayburn House Office Building
Washington, D.C. 20516

Dear Congressman Sharp:

With Hoosier Energy being a consumer-owned electricity producer utilizing Indiana coal and advanced environmental protection technology, we are extremely interested in your subcommittee's work, as reflected by our attendance at the June 20, 1988, Indianapolis field hearing on acid rain. On behalf of the more than half-a-million electric distribution cooperative consumers we serve in central and southern Indiana, we respectfully offer the following comments in regard to that hearing and its important topic.

We appreciate the opportunity to present our concerns regarding proposed acid deposition control legislation; we offer them in a spirit of cooperation, recognizing the pressure on Congress to address this complex issue.

Hoosier Energy's operating characteristics and accomplishments relative to acid deposition are tangible proof of our commitment to protecting the environment; recognition of the major financial investment our consumers have already made to that protection is most important when addressing this issue.

We believe that scientific studies do not support imposition of additional $SO_2$ emission controls at this time; our major concern being that without clear identification of a source/receptor relationship, expensive additional controls could dramatically increase electric rates to consumers without a matching benefit to environmental enhancement.

More than 80% of our 1,200+ megawatts of generating capacity is already equipped with a flue gas desulfurization system (at our Merom Generating Station) with an installed cost of $88-million and an annual operation and maintenance expense of nearly $7.5-million. Through this investment, the annual average $SO_2$ emission rate for this "scrubbed" capacity is maintained below the permitted standard of 1.2 lbs/mmBtu.

Our remaining capacity (the Ratts Generating Station built in the 1960s) also utilizes Indiana coal, cleaned at a nearby processing plant. This cleaning removes approximately 25% of the coal's sulfur at an estimated cost of $4/ton. In 1987, the total cost for this cleaning was about $2.4-million, an expense directly related to maintaining the annual average $SO_2$ emission rate for the Ratts Station below the permitted standard of 6.0 lbs/mmBtu for this type of facility.

On a systemwide in-state basis, Hoosier Energy has achieved an average $SO_2$ emission rate of less than 2 lbs/mmBtu, with the cost of this achievement already incorporated into the existing consumer electric rates.

But even with these major investments and accomplishments, current proposed national legislation would adversely affect Hoosier Energy, and therefore, the consumers we serve. Just one example is the "Equalization" provision in Section 187(d) of H.R. 2666, which could unjustly require our consumers to pay excess amounts to "equalize" rate increases to consumers of another utility which already has a lower rate and competitive advantage because that utility does not have significant $SO_2$ emission reduction costs in its ratebase--which is simply unfair to our consumers.

It's easy to understand why equitability has become the focus of discussion related to proposed acid deposition legislation. We know what these proposals will cost in higher electric rates and lost jobs if implemented--we just don't know what significant results, if any, might be achieved.

In closing, there are two important points we hope your subcommittee will consider carefully:

1. Congress had the foresight to establish a 10-year research effort on this subject; any additional acid deposition legislation is premature until the National Acid Precipitation Assessment Program study is completed.

2. In light of the major investments Hoosier Energy consumers have already made and are continuing to make every year to protect the environment, it is imperative that any strategy for further emission reduction give proper credit for such investments already in place.

Again, thank you and the other members of your subcommittee for the opportunity to make our concerns a matter of public record. If we at Hoosier Energy can be of any further assistance to you or your subcommittee, please don't hesitate to contact us.

Sincerely,

HOOSIER ENERGY REC, INC.

V. E. Peterson

Virgil E. Peterson
Executive Vice President
and General Manager

## Statement of

## Indianapolis Power & Light Company

Indianapolis Power and Light Company (IPL) serves the electricity needs of some 360,000 customers primarily in the City of Indianapolis. The company has four generating plants in Central and Southern Indiana.

The Clean Air Act requirements have had a positive and significant impact on the emissions from IPL generating plants. Since 1973, IPL's sulfur dioxide emissions have been reduced by 31%. Over this same period, IPL increased its coal burn 54%.

To date, IPL has approximately 39% of its coal-fired generating capacity fitted with $SO_2$ removal systems, and the company is in compliance with all environmental control rules and regulations.

This environmental control compliance has come at a significant cost to our customers. To date, IPL has invested over $467 million in environmental controls. In 1987, the cost of owning, operating and providing the required environmental protections accounted for over $.23 of every revenue dollar paid by IPL customers.

The various legislative proposals being considered by Congress would significantly increase the environmental compliance portion of our customers' bills. An analysis of the impact on our ratepayers of individual bills follows:

1. The acid rain portion of Senate Bill 1894 would require an IPL investment in excess of $650 million and necessitate a rate increase for our electric customers in the range of 35 to 45 percent. This estimate does not include the cost for compliance with Title V of that legislation. This area is not specific enough to address the cost.

2. HR 2666 (Sikorski Bill) would require an IPL investment of $420 million and raise our customers' electric rates from 20 to 30 percent.

3. HR 4331 (Cooper Bill) would require an investment in excess of $439 million. Electric rate increases on the order of 25 to 30 percent would be needed to cover this expense. This bill would have a higher cost than HR 2666, but the costs would be spread over a longer period of time.

4. There has been some consideration of a bill requiring generating boilers reaching 30 years of age by 1995 to meet the new source performance standards. This proposal, for IPL's unit age mix, would require a 25 to 35 percent rate increase. This type of proposal disproportionately affects the ratepayers of utilities which have carefully maintained their older and lower cost generating equipment to sustain lower customer electric rates. IPL and its customers are hit disproportionately hard by this type of legislation.

In determining the means of sulfur dioxide control required to meet these various bills, IPL uses scrubbers or low-sulfur coal, depending upon which methodology is estimated to have the lowest rate impact on our customers. All three bills result in a mixed IPL strategy utilizing both low sulfur fuel and flue gas desulfurization systems. $NO_x$ controls, where required, were estimated to be accomplished by modification to boilers to generate less nitrogen oxides.

IPL has a solid and effective record of protecting the environment today and in the future. The company is deeply involved in developing new emission control technologies, recently hosting the $6.6 million EBARA pilot test program to reduce sulfur dioxide and nitrogen dioxide emissions with new technologies. IPL also supports the research and development programs of the Electric Power Research Institute.

Indianapolis Power & Light Company endorses the position of the Indiana Electric Association as submitted in public testimony to the House Subcommittee on Energy and Power.

# STATEMENT OF THE INDIANA COAL COMMISSION
to the
# HOUSE OF REPRESENTATIVES ENERGY AND POWER SUBCOMMITTEE

Mr. Chairman and Members of the Subcommittee:

The Coal Commission was created by the Indiana General Assembly and extended by executive order of the Governor in order to recommend actions which Indiana's State Government can take to assist the coal industry in this State. The Commission welcomes the opportunity to present our views on pending acid rain legislation to your subcommittee.

The current acid rain bills being considered by Congress would be extremely costly to Indiana's electricity consumers, and would have devastating affects on our State's coal mining industry. Electricity rates are projected to increase from 12 percent to nearly 50 percent in Indiana if either of the pending bills are passed. Indiana coal production would decline by 3.7 to 4.7 million tons annually. We believe that these costs are far more severe than is justified from current scientific knowledge of acid rain. In short, the scientific information available at present can provide no assurance that the actions called for in pending legislation would lead to a significant reduction in acid deposition in the Northeast.

The goal of a healthy environment is one we all share. For this reason Indiana utilities have already installed a total of 9 scrubbers and reduced $SO_2$ emissions by approximately 25 percent from 1980 levels.

While the scientific community continues studies on acid rain, progress is being made on clean coal technologies. Less costly and more effective air pollution control equipment is being developed, with several projects already at the pilot testing phase. Congress should work toward developing technological solutions to the acid rain problem before mandating new legislation to cut emissions.

The Coal Commission strongly supports the Department of Energy's Clean Coal Technology Program (CCT). The CCT allows government to work in cooperation with industry to demonstrate technology options that can use coal as a source of energy in an environmentally responsive and efficient manner. Towards that effort, the Commission is presently working at a state level to develop incentives, both regulatory and financial, to encourage utilities and other industries to install clean coal technologies.

We further urge Congress to support the President's Innovative Clean Coal Technology Program which would provide $2.5 billion over the next 5 years. This program will expand the range of technologies available to cost effectively utilize coal while reducing emissions.

Congress must not overlook the strategic importance of coal to our nation's energy future. According to a 1980 report by the President's Commission on Coal, coal represents more than 80 percent of America's known recoverable energy reserves. It clearly makes more sense to develop environmentally acceptable technologies to utilize this valuable resource than to pass legislation which would cripple much of the coal industry and further increase the nation's dependence on imported energy.

Our nation should work to develop effective, long-term solutions to the acid rain phenomena. The worst case scenario is for Congress to enact legislation in haste which will lead to economic hardships in major areas of this country without solving the problem. Let us take the time necessary to develop effective technologies and ensure that whatever strategy is ultimately enacted will be successful.

## STATEMENT OF THE INDIANA ENERGY DEVELOPMENT BOARD

## HOUSE OF REPRESENTATIVES' ENERGY AND POWER SUBCOMMITTEE

Mr. Chairman and Members of the Subcommittee:

The Indiana Energy Development Board appreciates the opportunity to express its concerns about proposed acid rain control legislation being considered by Congress. The Energy Development Board was created by the Indiana General Assembly in 1980. The Board is charged with promoting and assisting the development and adoption of technologies which help to meet the energy needs of the state. Among the primary emphases of the Board's activities are efforts to encourage the utilization of Indiana coal reserves.

These coal reserves are a significant contributor to the net energy balance of the state. More than eighty percent of all the electricity generated in this state is produced from coal mined in the Illinois Basin, and ninety eight percent of all Indiana electricity comes from coal. Indiana coal consumed by Indiana utilities has provided relatively inexpensive electricity to the residential, commercial, and industrial consumers. The coal mining industry has also employed thousands of well-paid miners in a region where the unemployment rate is above the statewide average.

With this background established, the Board notes that acid rain control legislation threatens to impose a heavy economic and social burden on Indiana in order to address the not-yet-perfectly understood relationship of Midwestern emissions and Northeastern deposition. Until science is given time to better identify the precise relationship of the source-receptor interaction, no certainty exists that legislatively mandated emission cuts will achieve the desired change in the receptor environment. Far better would be a prudent course of rationally waiting to determine the most efficient reductions which must be made to achieve the needed changes in precipitation chemistry.

Science has shown that damage to terrestrial ecosystems which was once blamed solely on acid rain is very much a product of a complexly inter-related set of components, such as biotic agents, land use history, inter-species competition, weather, and atmospheric pollutants such as ozone and VOCs, along with nitrogen and sulfur deposition. Such complexity must be recognized as a given in any interpretation of society's impact on the environment; any attempts to resolve problems cannot realistically impose simplistic solutions on complex problems.

Given the continuing revelations of new facts on acid rain related issues, the Board urges Congress to withhold action until 1990. At that time NAPAP should allow for a reasoned and enlighten debate based on facts. Decisions as momentous as these must be made in a deliberate, rational manner. NAPAP's findings will allow Congress to consider prudent and cost-effective programs which inflict the minimum cost on the nation while satisfying the nation's environmental concerns.

# COMMENTS OF INDIANA MICHIGAN POWER (I&M) REGARDING ADOPTION OF ACID RAIN LEGISLATION

Subcommittee on Energy and Power
Committee on Energy and Commerce
U.S. House of Representatives
Hearing in Indianapolis, IN
June 20, 1988

These comments are filed by Indiana Michigan Power Company (I&M), the owner and operator of three coal-fired plants in Indiana:

| | | |
|---|---|---|
| Breed Plant | Fairbanks, IN | 400 MW |
| Rockport Plant | Rockport, IN | 1300 MW |
| Tanners Creek Plant | Lawrenceburg, IN | 995 MW |

I&M is an investor owned electric utility serving more than 460,000 customers in Northeast Indiana and Southwest Michigan and is a member of the American Electric Power System.

As can be seen in the following table, I&M has aggressively reduced $SO_2$ emissions during the 1980's:

| Year | $\#SO_2/10^6$ BTU | $10^3$ Tons $SO_2$ |
|---|---|---|
| 1983 | 5.43 | 144.2 |
| 1984 | 4.25 | 159.7 |
| 1985 | 2.97 | 153.3 |
| 1986 | 2.38 | 127.4 |
| 1987 | 2.60 | 115.4 |

This is a dramatic 52% decrease in the production rate of $SO_2$ from I&M power plants and a significant reduction in tonnage even though a new 1300 MW generating unit was brought on line in late 1984. Furthermore, under new state requirements the $SO_2$ emission limitations for Tanners Creek Plant Unit 4 will be lowered by 37% over the next several years. Certainly, I&M's commitment to overall environmental protection has been substantial. Total capital investment for air quality protection through 1987 was 238.3 million dollars. In addition the total environmental operation and maintenance expense for 1987 alone was 67.7 million dollars.

Despite this record of achievement, a number of bills now pending in Congress would impose severe penalties upon I&M and the AEP System. Under the worst case scenario presently envisioned, I&M's industrial customers could face up to a 23% rate increase as a result of H.R. 2666. Most of the proposals would cost customers of the AEP System in excess of one billion dollars. The ripple effect of such drastic measures would surely stunt, if not halt, the Midwest's economic recovery.

Possibly the most damaging result of acid rain legislation would be the fatal blow it would strike to our most promising clean coal technologies. The capital investment required for retrofitting $SO_2$ scrubbers on existing plants would force the abandonment of major development projects now underway.

On April 6, 1988, groundbreaking ceremonies took place for American Electric Power's Pressurized Fluidized Bed Combustion (PFBC) operating unit at Tidd Plant in eastern Ohio, culminating 12 years of research and development by AEP and its manufacturer allies. The 70 MW facility will cost approximately 178 million dollars and should be operational by the fall of 1990.

In a PFBC boiler, coal is burned with limestone in a churning "fluidized" bed. In the burning process, the sulfur chemically combines with the limestone and becomes trapped in the ash, resulting in 90% removal of sulfur pollutants and making disposal easier. The coal is also burned at a relatively low combustion temperature, resulting in less than half the nitrogen oxide emissions of a comparable plant of conventional design.

On May 19, 1988 AEP announced an ever larger venture toward the commitment to clean-coal technology, by proposing to transform two units of the Philip Sporn Plant in West Virginia into the world's largest PFBC facility (330 MW).

This mammoth undertaking would cost 579 million dollars two-thirds of which AEP would pay provided federal and state cost-sharing funds can be obtained.

The PFBC technology holds the promise of coal-based energy independence for the entire country -- a lower cost, clean, and efficient use of coal for America's future. Pending acid rain legislation could seriously jeopardize PFBC and other threshold technologies, however. If utilities are forced to spend limited funds adding outdated scrubbers to existing plants, these newer projects would be severely delayed or cancelled. There simply is not enough money to do both.

The scientific uncertainties punctuated by the NAPAP Interim Assessment are so great that only three weeks ago, not one of the eminent witnesses appearing before this committee believed that current knowledge necessitated adoption of proposed legislation. Even Dr. Ellis Cowling of the National Academy of Sciences admitted during the hearing on May 26 that the need for legislative action is not as urgent as the Academy had believed in 1981. It is imperative that Congress accept the NAPAP interim assessment and await the final assessment before taking further action. Indiana Michigan Power sincerely appreciates the opportunity to present these comments.

Statement
of
Rajeshwar G. Rao, General Manager
INDIANA MUNICIPAL POWER AGENCY
before the
SUBCOMMITTEE ON ENERGY CONSERVATION AND POWER
HOUSE COMMITTEE ON ENERGY AND COMMERCE
on
"ACID RAIN LEGISLATION"

June 20, 1988

My name is Rajeshwar G. Rao, and I am the General Manager of the Indiana Municipal Power Agency (IMPA). IMPA was created in 1980 pursuant to Indiana Law to provide a method for its 25 member towns and cities to jointly finance, develop, own and operate electric generation and transmission facilities to provide their present and projected electric energy needs. These towns and cities provide retail electric service to over 128,000 customers almost 90% of whom are residential customers. Four of the 25 members, Richmond, Crawfordsville, Peru and Rensselaer (Generating Members) own and operate small generating units of less than 100 MW. In addition, IMPA owns approximately 25% of Gibson unit no. 5, a 650 megawatt coal fired unit operated by Public Service Indiana in Gibson County. This particular unit is equipped with a scrubber for removal of sulfer dioxide emmissions.

I. Legislation should be deferred to allow technological advances to solve many emission problems. IMPA and the Generating Members urge this Sub-Committee not to act in haste to adopt draconian acid rain legislation until experimental technologies have been given an opportunity to reduce $SO_2$ and $NO_x$ emissions. Municipal electric utilities operating small electrical generating facilities in Indiana have not ignored air pollution.

For example, recently Richmond was chosen for a four-year experiment by the Energy and Environmental Research Corporation (which is conducting the $2.6 million project for the U.S. Environmental Protection Agency and Electric Power Research Institute) to evaluate sorbent injection for $SO_2$ emission control on utility boilers. Richmond operates a municipally owned electric utility with two coal-fired generators. These generating facilities are dedicated to IMPA so that the savings between the costs of ownership and operation and the costs of purchased power are passed on to all of IMPA's 25 members. Presently the Richmond unit being used for the four-year test burns medium sulfur Indiana coal with no $SO_2$ emission control.

The first test evaluation of the Limestone Injection Multi-Burner (LIMB) system is completed. It involves upper furnace injection of a calcium based sorbent for $SO_2$ emissions which will be reduced by about 50% by the sorbent injection technology with no increase in other pollutants. If the emission control system remains in operation, $SO_2$ emissions will be reduced in Richmond by about 4,000 tons per year. For a unit of Richmond's size, this dry technology is much simpler and more cost effective than conventional wet scrubbers, although preliminary tests have shown that LIMB will be 40-60% efficient compared to 80-90% for conventional wet scrubbers. However, wet scrubbers cannot be installed economically[1] in Richmond.

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[1] Electric Power Research Institute's research paper on the economics of wet scrubbers for small unit institution is enclosed for reference.

Peru, another IMPA member whose two coal-fired steam turbines have been dedicated to the Agency for the joint benefit of its members, has engaged engineering consultants to determine the economic and engineering feasibility of adding precipitators to the units so as to allow them to burn low sulfur coal. The economic feasibility of using low sulfur coal on such size units, however, has not yet been demonstrated.

Peru has recently undertaken studies that will let it increase the use of its 10 megawatt Unit No. 3. These studies recommend the addition of an electrostatic precipitator at a capital cost of approximately $2,000,000 which will immediately reduce particulate emissions and which will make possible the use of low sulfur coal so as to reduce sulfur dioxide emissions to approximately 1.2 pounds. The same studies, however, indicate that the use of low sulfur coal acquired in the eastern United States will result in 70% higher fuel cost. In addition to the increased capital expenditure resulting from the construction of the electrostatic precipitator, operating expenses for the unit are projected to increase from 3 to 4 percent.

Consequently, IMPA believes that sizable reductions in emissions for small municipally owned generators may be achieved without the enactment of acid rain legisaltion. Technologies such as that being tested at Richmond are technically feasible and can be implemented in such a manner as to allow the continued operation of small municipally owned electric generating facilities. Enactment of acid rain legislation would quite probably force the closing of all of IMPA's members' coal-fired generation if its terms were strictly applicable to such small generators.

II. Acid Rain legislation should recognize the peculiar problems of compliance by small electric generators and provide a different standard of emission reductions for small and large generating facilities.

Although in Indiana a very substantial part of retail electricity requirements are provided by large investor-owned utilities owning and operating many very large generating facilities,[2] part of Indiana's electric load is provided by 78 municipally owned electric utilities which provide retail electric service within their respective municipal boundaries. Of these municipally owned electric utilities, IMPA members Richmond, Peru, Crawfordsville and Rensselaer generate electricity as do non-IMPA members Logansport, Bluffton and Jasper. Compared to the investor owned utilities, however, the facilities operated by Indiana's municipally owned electric utilities are extremely small. Peru, for example, has a total coal-fired generating capability of 32 megawatts, Logansport 38.5 megawatts, Jasper 14.5 megawatts, Crawfordsville 24.2 megawatts and Richmond 93 megawatts. Bluffton and Rensselaer both operate oil-fired facilities.

None of the legislation offered on acid rain really addresses the unique requirements of small generating facilities. Wet scrubber technology or Western clean coal are normally viewed as the means by which large generating facilities can reduce $SO_2$ emissions. Wet scrubbers are not an option available to small units since the capital cost per kilowatt of reducing emissions is significantly higher than for large generating units. Operating and maintenance costs are also higher for the smaller units per KWH of output. Moreover, the smaller municipally owned units in Indiana tend to be used only during peak or near peak load periods. This also tends to increase the cost of fuel per kilowatt hour in comparison to the cost associated with larger base load units. The capital cost associated with retrofitting small municipally owned units is compounded further by the fact that many of the units are in densely populated areas where land for constructing emission control equipment is either nonexistent or very scarce. The cost of engineering around such constraints magnifies the capital cost of emission control. Finally, low sulfur coal may not be a reasonable option for many of the small units since it is generally unavailable in Indiana, may not be usable without expensive retrofits, and will be very costly if imported. The capital and operating costs for use of low sulfur coal at Richmond, for example, are estimated to result in a 50% rate increase. Attached to this position paper as Appendix A is a short summary narrating the impact of acid rain legislation upon a typical, small municipal electric utility, e.g., Crawfordsville, Indiana (prepared by American Public Power Association).

---

[2] Indiana & Michigan Electric Company, for example, recently completed a 1300 megawatt unit on the Ohio River in Indiana and has another such unit nearing completion. Public Service Company of Indiana has several units of 650 megawatts.

Consequently, IMPA and its Generating Members respectfully request that any acid rain legislation take into account the unique problems which face small generating units owned and operated by municipally owned utilities and provide, in the law, relief by way of exemption for generators with 100 megawatts or lower or in some other manner from the same level of emission reduction imposed on large generating facilities.

## APPENDIX A

## THE IMPACT OF ACID RAIN LEGISLATION ON CRAWFORDSVILLE, INDIANA, AND THE INDIANA MUNICIPAL POWER AGENCY *

Crawfordsville Electric Light and Power, a municipally owned utility located 45 miles west of Indianapolis, supplies electricity to a population of 13,000. THe utility buys much of its power from the Indiana Municipal Power Agency (IMPA), a joint action agency with 25 Indiana municipal utility members.

IMPA purchses power at wholesale from several investor owned utilities and is a part owner (155 MW) of the 600 MW Gibson 5 unit of Public Service Company of Indiana. IMPA also operates a power pool of powerplants owned by IMPA members. Included in the pool are the 60 MW and 30 MW Richmond, Indiana, coal plants, the 32 MW Peru, Indiana, coal plant, and the 24 MW Crawfordsville coal plant.

The Crawfordsville plant burns stoker coal in two units. The two units were built in 1955 and 1965 and are 11.5 MW and 12.65 MW in size. Both units burn prewashed Indiana stoker coal of 2 to 2.5 percent sulfur coal, which results in a $SO_2$ emission rate of 3.3 to 4.0 lbs./MBtu. Because the 24 MW plant is used for peaking, its capacity factor is low -- approximately 30 percent, according to IMPA.

Crawfordsville could have to retire its 24 MW coal plant should acid rain legislation be enacted, and shutdown would be forced if default were triggered.

Purchasing very low sulfur compliance coal is not an option; transportation costs for the coal would make operation of the plant uneconomic even as a peaker. Crawfordsville would need to install a scrubber to meet either the 2.0 or the 1.2 lb./MBtu $SO_2$ emission rate requirement.

The cost of retrofit scrubbers, however, would be prohibitively high. An estimate for the 24 MW plant, made by R. W. Beck, Inc., is $600 per kilowatt. In contrast, the Electric Power Research Institute (EPRI) recently estimated a national average cost of $295 per kilowatt for scrubber retrofits.

The actual costs of installing scrubber retrofits at Crawfordsville could well exceed the estimate, since the powerplant has extemely limited physical space for installation. The plant is located in an urban area with a hill on one side and a river on the other. Any scrubber installation would have to be made vertically, which greatly increases the cost.

The low capacity factor of the Crawfordsville plant makes a scrubber retrofit even more impractical. In general, the cost of removal for $SO_2$ more than doubles as capacity factor declines -- from $1,100 per ton of $SO_2$ removed for a base load capacity factor of 70 percent, to $2,800 per ton of $SO_2$ removed at a 20 percent capacity factor (Source: EPRI, Attachment C). This estimate is for large plants; "double" costs would be approximately accurate for small plants as well, except for much higher absolute costs due to diseconomies of scale and urban site accessibility/congestion problems.

The costs of compliance would force shutdown of IMPA's Peru and Richmond plants as well. These plant shutdowns would have a dramatic impact on IMPA's utility members. The first impact would be immediate: IMPA estimates a rate increase of more than 24 percent, due to the cost of replacing the peaking power from these plants with more expensive power from investor owned utilities. The second impact is more difficult to quantify, but no less important: IMPA would lose leverage it now has to negotiate wholesale power purchases with investor owned utilities.

---

* Extract from American Public Power's paper dated April 1987 titled "The Need for Specific Provision in Acid Rain Legislation for Small Electric Generating Plants".

EPRI
Electric Power
Research Institute

Attachment A

July 16, 1986

Mr. Larry Mansueti, Staff Engineer
American Public Power Assoc.
2301 "M" Street, NW
Washington, DC 20037

Dear Larry:

With regard to our recent telephone conversation concerning the costs of the flue gas desulfurization (FGD) systems, there are several points I'd like to clarify.

In response to your inquiry about the costs of FGD systems for coal-fired units below 100MW, I noted that EPRI does not, in fact, extrapolate our economic data below 100MW in our Retrofit FGD Cost-Estimating Guidelines (CS-3696). Our "standard" plant from which cost adjustments are applied is a 500MW unit. Figure 5-1 (attached) from CS-3696 illustrates the Proces Adjustment Cost Factor used for unit size. For a conventional wet limestone FGD system, it can be seen that the process adjustment cost factor for a 100MW unit would be approximately 1.75. Therefore, we would estimate that the capital cost for an FGD system on a new 100MW plant would be approximately $350/kW, expressed in January 1986 dollars. Please note that the level of accuracy of this cost-estimating procedure decreases significantly below the 200MW size due to the wide variations in conditions encountered with such small units.

Our cost-estimating procedures provide further adjustment factors for converting the cost of an FGD system at a new "standard" plant to allow estimation of site-specific retrofit FGD costs. This is done by means of employing adjustment factors for location, scope and retrofit difficulty. Examples of these are climate, seismic zone, soil conditions, and labor rate factors for location; chimney and/or boiler draft system modifications, demolition and relocation factors for scope; and underground obstructions, accessibility, congestion, and distance to scrubber factors for retrofit adjustments. In severely constrained sites, such as those which might be anticipated at older, smaller units in urban locations, the total adjustment factor could easily approach or even exceed 2.0, i.e., twice the cost of a new unit.

*3412 Hillview Avenue, Post Office Box 10412, Palo Alto, CA 94303 Telephone (415) 855-2000*
*Washington Office 1800 Massachusetts Ave., N.W., Suite 700, Washington, DC 20036 (202) 872-9222*

Lastly, let me clarify the derivation of the $298/kW (January 1986$) "average" figure quoted in Kurt Yeager's response to Congressional testimony question number thirteen. I used the statistical means for coal sulfur content (2.5%) and unit size (280MW) from the set of the top 120 $SO_2$ emitting stations identified on EPA preliminary report of Contract No. 68-01-6614, and applied a medium retrofit difficulty factor of approximately 1.45. With these inputs our cost-estimating procedure yielded a result of $298/kW for this "average" unit.

If you require additional information or further clarification, please contact me.

Sincerely,

Robert E. Moser

Robert E. Moser
Project Manager
Desulfurization Processes Program
Coal Combustion Systems Division

REM:ns

Attachment B

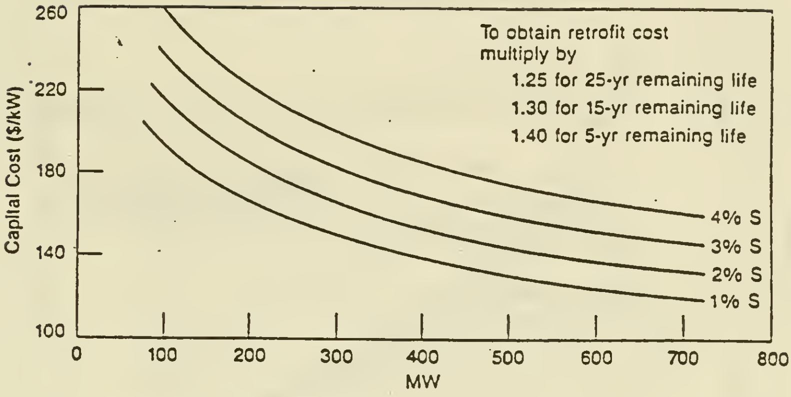


Figure 5-11. Conventional Limestone FGD - Total Capital Requirement Versus Size

CAUTION: Use these curves for relative comparisons only. For more rigorous analyses of retrofit costs, see Section 6.

Basis: Midwest Site
4% S Coal
EOY 1982 $
New Plant (2 x 500 MW)

*Source: "$SO_2$ and $NO_x$ Retrofit Control Technologies Handbook," EPRI CS-4277-SR, October, 1985.*

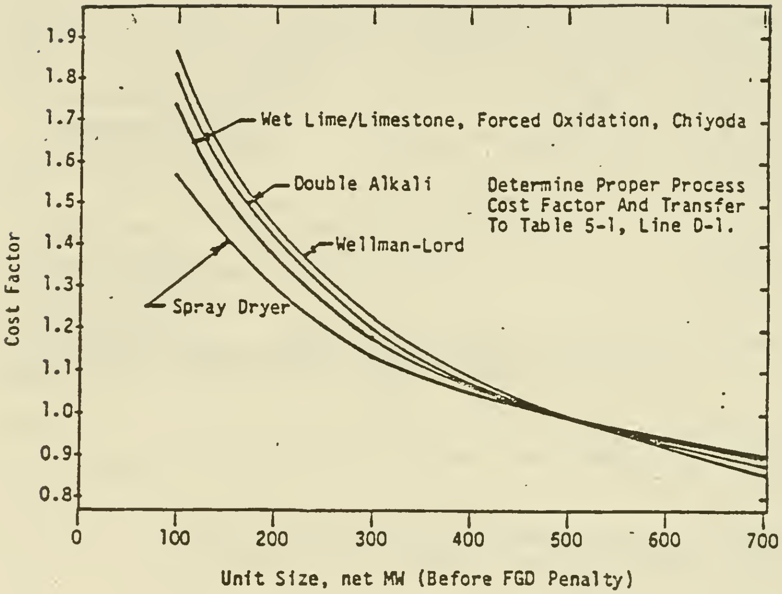


Figure 5-1. Unit Size Process Adjustment Cost Factors

*Source: "Retrofit FGD Cost-Estimating Guidelines," EPRI CS-3696, October, 1984.*

Attachment D

Table 5-1 (Continued)

TOTAL RETROFIT CAPITAL COST ESTIMATE SUMMARY

F. Retrofit Factors (_______)

1. Site Accessibility and Congestion

   a. BASE - Interferences similar to new plant with adequate crew work space. Free access for large cranes and equipment area around boiler and stack adequate for standard layout of scrubber equipment. For this case, use a factor of 1.02. (Approximately 45 sq. ft./MW).

   b. LOW - Some above ground interferences and work space limited. Access for large cranes limited to two sides, equipment cannot be laid out in standard design. Some equipment must be on elevated slabs or located remotely. For this case, use a factor of 1.08. (Area around boiler and stack approximately 35 sq. ft./MW).

   c. MEDIUM - Limited space. Interference with existing structures or equipment which cannot be relocated. Special designs are necessary. Access for cranes limited to one side, majority of equipment on elevated slabs or remotely located. For this case, use a factor of 1.25. (Area around boiler and stack approximately 30 sq. ft./MW).

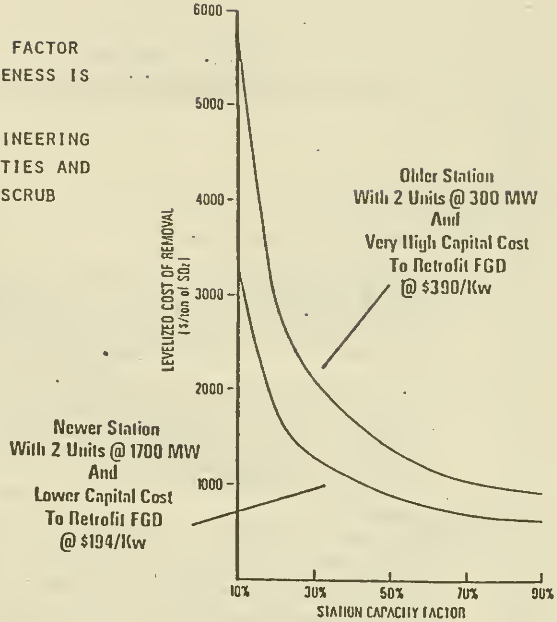
   d. HIGH - Severely limited space and access. Crowded working conditions. Access for large cranes blocked from all sides. For this case, use a factor of 1.42. (Area around boiler and stack approximately 25 sq. ft./MW).

*Source: "Retrofit FGD Cost-Estimating Guidelines," EPRI CS-3696, October, 1984.*

Attachment C

THE INFLUENCE OF CAPACITY FACTOR ON SCRUBBER COST EFFECTIVENESS IS DRAMATIC.

THIS EFFECT OUTWEIGHS ENGINEERING COST ESTIMATION UNCERTAINTIES AND EXPLAINS DISINCENTIVE TO SCRUB INTERMEDIATE UNITS.



Levelized Cost Of $SO_2$ Removal
vs. Station Capacity Factor

*Source: "Fitting Low-Sulfur Coal into the Compliance Equation," J. Platt, EPRI, May 12, 1986, preliminary draft.*

SPIRIT OF SEVENTY-FIVE
PUBLIC SERVICE INDIANA
1912-1987

July 14, 1988
File No. AR 60.412

The Honorable Phillip R. Sharp, Chairman
House Subcommittee on Energy and Power
House Committee on Energy and Commerce
Room H2-331
House Office Building Annex No. 2
Washington, DC 20515

Dear Representative Sharp:

Public Service Indiana wants to express our appreciation for the opportunity for Mr. Darrell Menscer, our President and Chief Operating Officer, to testify on the likely impact of acid rain legislation when your subcommittee held its field hearing in Indiana on June 20,1988. This legislation is important to our ratepayers and we believe that Congress must be kept aware of the broad economic impact it would have on much of the Midwest.

During the hearing you asked Mr. Menscer to identify what factors make the biggest difference in reducing the costs (of acid rain legislation). I submit on behalf of Mr. Menscer, our Company's position on this question.

There are several important factors which will affect the final cost to our Company's ratepayers. The size or amount of the reduction plays an important role. Industry studies have shown that each two million tons added to the reduction requirements doubles the annual cost of compliance. In other words, an increase from an eight million ton reduction to a ten million ton reduction would double the cost. An increase to twelve million tons would double the cost again and would be four times as costly as an eight million ton bill.

The timing of the reductions plays an important role in costs in at least four ways. First, if clean coal technology is to play a role in meeting the requirements of acid rain legislation, enough time must be allowed for these new cost effective technologies to be tested and proven for retrofit. Second, timing affects the cost of altering or buying out of existing coal contracts. Extended reduction schedules will reduce the expense of altering existing contracts. Third, additional time will allow the developing western coal enhancement technologies to be improved to the point that they may become cost competitive for fueling existing Midwestern boilers.

1000 East Main Street, Plainfield, Indiana 46168 317 .. 839 . 9611

Finally, timing affects the cost by the historical time value of money. Given a choice, most investors would prefer to delay a large investment until tomorrow rather than pay today.

The flexibility allowed utility systems and states in meeting a required reduction will affect the final cost. Flexibility starts by not dictating in the legislation the technology to be used or the specific plants to be controlled. Flexibility is enhanced by setting a target reduction amount and not by setting across the board emission limits. Finally, any proposal that requires control of our country's oldest and least used units, will not result in a cost effective solution.

Cost sharing is another important factor that will affect the cost to our Company's ratepayers. Most acid rain legislation proposed to date would cause a few Midwestern states, including Indiana, to incur a disproportional share of the cost. If the science shows that acid rain legislation is needed, that legislation should include an effective national cost sharing provision.

Representative Coates asked Ms. Emily Kress, President, Indiana Wildlife Federation to provide documentation on her testimony which addressed premature deaths attributed to acid rain and air pollutants. I believe that she was citing an interim draft report prepared for the Office of Technology Assessment entitled "THE REGIONAL IMPLICATIONS OF TRANSPORTED AIR POLLUTANTS: AN ASSESSMENT OF ACIDIC DEPOSITION AND OZONE" (July 1982). I have attached a critique of that report entitled "WHITE PAPER ON THE HEALTH EFFECTS OF SULFUR OXIDES: CRITIQUE OF THE SULFUR-RELATED MORTALITY ESTIMATES OF THE OFFICE OF TECHNOLOGY ASSESSMENT INTERIM DRAFT REPORT ..." prepared for Peabody Coal Company.

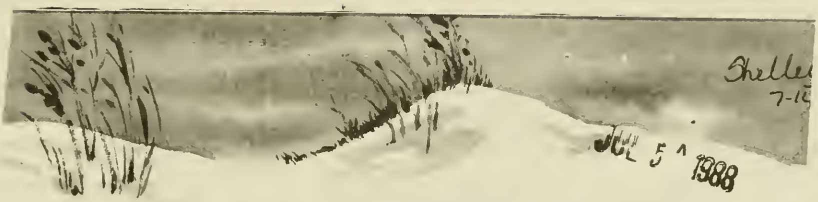
Please make this white paper, along with this letter a part of the official record of the June 20, Indianapolis hearing. Again, I appreciate the opportunity to share our Company views on acid rain. If you or your staff have additional questions, I would be pleased to respond.

Sincerely,

Gerald L. Raley

Gerald L. Raley, Director
Environmental Programs

GLR:jjh
Attachment
cc: Honorable Dan Coates
    Mr. Darrell V. Menscer



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JUL 5 1988

Save the Dunes Council

ORGANIZED IN 1952

P.O. BOX 114 • BEVERLY SHORES, INDIANA 46301 • TELEPHONE 219/879-3937 OR 926-2224

June 29, 1988

The Honorable Philip R. Sharp, Chair
Subcommittee on Energy and Power
House Committee on Energy and Commerce
House Office Building
Washington, D.C. 20515

Dear Congressman Sharp:

On behalf of the Save the Dunes Council and myself personally, thank you for the opportunity to present testimony favoring acid rain control at your June 20 public hearing on acid rain and the Midwest.

The general quality of the air in Northwest Indiana, especially in north Lake and Porter counties can only be described as unsatisfactory. The enclosed cartoon describes our air quality situation fairly colorfully.

To amplify my testimony at the June 20 hearing, regarding the acid rain problems at the Indiana Dunes, I have enclosed the following:

1. The 1987 Air Quality Report for the Indiana Dunes National Lakeshore, which contains data on acid rain gathered at the Lakeshore since 1980. Because I was curious about the highest pH reading and also the lowest for the park in 1987, I called Lou Brenan, who is in charge of the Lakeshore's air monitoring program. He gave me the following information:

| | |
|---|---|
| 1987 High, April 7, 1987 | pH 6.19 |
| 1987 Low,January 6, 1987 | pH 2.89 |

I also asked Lou for the data gathered so far for 1988. To date, the geometric mean of the acid deposition for 1988 is 4.70pH. However, he did point out that the dry weather and the resultant wind-blown dust do have a buffering effect and the actual pH could be lower.

2. The 1985 listing, distributed by the National Clean Air Coalition in 1987, of the places experiencing the most acid rainfall, single event. Unfortunately, Indiana Dunes was in the top ten with a pH of 3.38.

3. A report by the Chief Scientist of the Indiana Dunes National Lakeshore on the nown damage to natural resources within the park from SO2.

4. Information on acid rain (and other air pollutant) effects on national parks,in National Park Service reports and publications:

These include an article in the Summer 1985 issue of Park Science entitled "Overview of Air Pollution Effects on National Park Vegetation in 1985," which includes Indiana Dunes in its data. In addition, I am including some data from the NPS Midwest Region regarding air pollution problems affecting park resources.

5. Correspondence and newspaper clippings regarding the effects on boats and buildings of pollution from the coal fired power plant operated by Northern Indiana Public Service Company in Michigan City. Because there are no other large sources of pollution near the historic building and the marina basin where the damage occurs other than the NIPSCO plant, it is obvious that the power plant emissions are the culprit.

6. A chart showing the point of origin of coal, by state and county, used in 1984 by NIPSCO. In my testimony June 20, I stated that NIPSCO uses only Illinois or low-sulfur western coal. While most of the high sulfur coal comes from Illinois, NIPSCO does use some Indiana coal. I apologize for the misinformation previously provided.

It is clear to the Save the Dunes Council that acid rain and other air pollutants are damaging the resources of the Indiana Dunes National Lakeshore and other national parks as well. This may not seem to be a serious problem to persons unfamiliar with or unsympathetic to parks and their value. However, visible damage to park vegetation, such as is occurring at the Indiana Dunes, is a warning flag for humans and human health as well as for the health of vegetation outside of our parks.

It is also clear to the Council that acid rain and other air pollutants are causing physical damage to boats and buildings in Michigan City. NIPSCO customers, myself included, are paying the price of repairing the damage caused by air pollution to the boats and buildings. How much better it would be to control the cause of the problem, rather than endlessly paying to repair the damage. The public bears the cost either way.

The Council believes the time has come to enact acid rain legislation, for the good of our parks and our people.

Sincerely,

Charlotte J. Read

Charlotte J. Read
Executive Director

# 1987 AIR QUALITY REPORT
# INDIANA DUNES NATIONAL LAKESHORE

By: Louis Brenan
Office of Resource Management

For the first time since 1984, ozone levels exceeded the standard of 0.12 parts per million (ppm) for an hourly average. In fact this standard was exceeded 8 times during the summer with excursions occurring on June 18, July 21, and July 30.

The sulfur dioxide levels remained relatively low at 0.007 ppm, with the EPA acceptable limited being 0.03 ppm. The sulfur dioxide levels have remained fairly constant over the last 8 years.

Total suspended particulate levels at West Beach and the Bailly Ranger Station were 36 and 38 micrograms per cubic meter respectively, approximately the same as the last several years.

Acid precipitation monitoring at Indiana Dunes has revealed a ph of around 4.18 for 1987. This is a decline of 0.20 ph units from 1986. A statistical check reveals that there is no trend in the eight years of acid rain data.

## Total Suspended Particulates

Indiana Dunes National Lakeshore owns and operates two ambient air monitoring sites located within its boundaries. These sites are located at the Bailly Ranger Station and at West Beach. The site at Bailly Ranger Station monitors for total suspended particulates, (TSP) sulfur dioxide, ozone and acid rain. The site at West Beach monitors for TSP only.

The TSP monitoring site at the Bailly Ranger Station is located on an elevated platform located approximately 300 feet north of the buildings. TSP consists of all solids and aerosols which may exist in the air at ambient temperatures. The various pollutants lumped under TSP are not actually differentiated as to their chemistry or origin.

TSP may and usually does contain a wide variety of substances such as flyash from coil-fired boilers, iron oxide particles from steelmaking, and fugitive dust from roads and agriculture. The standards for TSP are 75 micrograms per cubic meter (ug/m3) for a yearly geometric mean and 260 ug/m3 for 24 hour maximum which can be exceeded only once per year.

The Bailly Ranger Station measured a TSP level of 38 ug/m3 during 1987, and West Beach has a TSP level of 36.5 ug/m3. This represents a slight decline from 1986 for Bailly and no change for West Beach. The TSP levels at both locations have remained constant or declined slightly since sampling began in 1981. Table I summarizes the TSP levels at Bailly Ranger Station and West Beach for the last several years.

Table 1- Total Suspended Particulate Levels at Indiana Dunes

| Year | Bailly | West Beach |
|---|---|---|
| 1981 | 47 | -- |
| 1982 | 46 | 43 |
| 1983 | 45 | 42 |
| 1984 | 46 | 43 |
| 1985 | 47 | 46 |
| 1986 | 41 | 36 |
| 1987 | 38 | 36.5 |

Note: All figures expressed as annual geometric mean in micrograms/meter3

## Sulfur Dioxide

Sulfur dioxide is a colorless gas that is produced primarily by the combustion of coal and fuel oil. It can cause damage to sensitive plants and also can be irritating to the respiratory system of humans. The Environmental Protection Agency has set limits on the allowable levels of sulfur dioxide in the ambient air. The agency has set a limit of 0.03 ppm sulfur dioxide as an annual mean, 0.14 ppm as a maximum three hour average.

The 1987 annual mean for sulfur dioxide was 0.007 ppm, a slight decline over the last eight years. The highest 24 hour average was 0.047 ppm, approximately one third the EPA standard of 0.14 ppm. The three hour maximum level was 0.104 ppm, about one fifth the allowable level of 0.500 ppm, white the current levels of sulfur dioxide are well below the national ambient Air Quality Standards of EPA, they still may cause damage to sensitive species such as lichens which may suffer at levels of 0.003 ppm.

Table II- Sulfur Dioxide Levels at Indiana Dunes National Lakeshore

| Year | So2 in ppm (Annual Mean) |
|---|---|
| 1981 | 0.010 |
| 1982 | 0.010 |
| 1983 | 0.008 |
| 1984 | 0.008 |
| 1985 | 0.009 |
| 1986 | 0.006 |
| 1987 | 0.007 |

While the 1987 sulfur dioxide sampling results for state operated sites in Porter County are not yet available. the 1986 results are listed in Table III since the 1987 values should not be substantially different.

Table III- Sulfur Dioxide Levels in Northwest Indiana

| Location | So2 in ppm Annual mean |
|---|---|
| Indiana Dunes | 0.007 (1987) |
| Portage | 0.005 |
| Ogden Dunes | 0.006 |
| Burns Harbor | 0.007 |

## Ozone

Ozone is a colorless, irritating gas that is produced by the action of sunlight on the oxides of nitrogen and other pollutants. Ozone is sometimes referred to as a secondary pollutant since it is not produced directly by most processes. It is the pollutant which is most irritating to humans and most stressfull to many plants. Concentrations of 0.20 ppm often produce respiratory discomfort in otherwise healthy people. This level of ozone is reached during the summer in many large urban areas throughout the country. The EPA has passed an ozone standard that sets a maximum one hour concentration of 0.12 ppm which can be exceeded only once per year.

The highest hourly average for ozone during the summer of 1987 was 0.154 ppm; the second highest hourly average was 0.15 ppm. This means that the Indiana Dunes area is in violation of the EPA ozone standard and that Porter County is correctly classified as a non-attainment area. Table IV shows the results of ozone monitoring since 1984. While there were seven excursions above the EPA ozone limit in 1987, there were none in 1986 or 1985.This is probably more a function of the weather than of actual emission levels. 1987 was a hotter summer than 1986 or 1985. Ozone levels were higher in 1987 for this reason despite lower emission rates due to such programs as auto tailpipe tests in Lake and Porter counties.

Table IV- Ozone levels at Indiana Dunes National Lakeshore

| Year | Day | Ozone Level (ppm) |
|---|---|---|
| 1984 | 12 July | 0.120 |
| 1984 | 3 Aug | 0.120,0.125,0.130,0.125,0.120 |
| 1984 | 4 Aug | 0.120,0.130 |
| 1984 | 15 Aug | 0.122 |
| 1984 | 16 Aug | 0.125,0.120 |
| 1985 | | No exceedances |
| 1986 | | No exceedances |
| 1987 | 18 June | 0.129 |
| 1987 | 21 July | 0.154,0.151, 0.134,0.121 |
| 1987 | 30 July | 0.133,0.132,0.127 |

## Acid Rain

While acid rain is not a criteria pollutant, its effects are in many ways just as important. It has been blamed for killing fish in Canada and New England by lowering the pH below that at which fish can reproduce. Acid rain is produced by the scavenging effect of rainfall on nitrates and sulfates which have been emitted into the atmosphere. The pH of rainfall in unpolluted environments should be approximately 5.6. Any pH lower than this is considered unnaturally acidic.

Acid rain has been monitored at Indiana Dunes since 1980. In fact Indiana Dunes is a member of the National Atmospheric Deposition Program (NADP). This network has set up very strigent quality assurance procedures on all phases of sampling. As such, the data can be considered representative of the rainfall in the area.

The pH during 1987 was measured at 4.18, based on the geometric mean of all weekly samples. While this is a decrease in the pH from last year, a preliminary analysis indicates that there is no downward trend. Table V shows the results of acid rain monitoring since 1980.

Table V- pH Levels of Rainfall at Indiana Dunes National Lakeshore

| Year | pH |
|---|---|
| 1980 | 3.88 |
| 1981 | 4.38 |
| 1982 | 4.31 |
| 1983 | 4.36 |
| 1984 | 4.29 |
| 1985 | 4.26 |
| 1986 | 4.38 |
| 1987 | 4.18 |

The sulfur dioxide and ozone monitors were wired to a SUM-X digital datalogger in June. This has greatly facilitated the handling of data. The installation is due for a major upgrade in February, 1988, with the aquisition of meterological equipment. The computer will sample wind speed and direction, temperature, relative humidity and sunshine. This will make possible additional studies such as correlation of wind direction and ozone levels.

## MOST ACID RAINFALL, 1985
## SINGLE EVENT

| State | Monitor Location | Lowest pH | Number of Times More Acid Than Normal |
|---|---|---|---|
| S. Carolina | Clemson | 3.16 | 275 |
| Virginia | Charlottesville | 3.29 | 204 |
| Massachusetts | East | 3.32 | 191 |
| New Hampshire | Hubbard Brook | 3.36 | 174 |
| Mississippi | Coffeeville | 3.37 | 170 |
| [redacted] | [redacted] | [redacted] | [redacted] |
| New York | Chautauqua | 3.38 | 166 |
| N. Carolina | Clingman's Peak | 3.40 | 158 |
| Pennsylvania | Penn State | 3.42 | 151 |
| Georgia | Georgia Station | 3.43 | 148 |
| Kentucky | Land Between the L | 3.50 | 126 |
| Massachusetts | Quabbin Reservoir | 3.50 | 126 |
| N. Carolina | Lewiston | 3.51 | 123 |
| Ohio | Wooster | 3.55 | 112 |
| Maryland | White Rock | 3.57 | 107 |
| Ohio | Caldwell | 3.57 | 107 |
| New York | West Point | 3.60 | 100 |
| Vermont | Underhill | 3.61 | 98 |
| Texas | Longview | 3.63 | 93 |
| New York | Bennett Bridge | 3.64 | 91 |
| Tennessee | Walker Branch | 3.64 | 91 |

## MOST ACID RAINFALL, 1985
## ANNUAL AVERAGE

| State | Monitor Location | Average pH | Number of Times More Acid Than Normal |
|---|---|---|---|
| Ohio | Caldwell | 4.16 | 27 |
| New York | Aurora | 4.17 | 27 |
| New York | Chautauqua | 4.17 | 27 |
| Pennsylvania | Penn State | 4.17 | 27 |
| New York | Bennett Bridge | 4.19 | 26 |
| West Virginia | Parsons | 4.19 | 26 |
| Pennsylvania | Kane | 4.20 | 25 |
| Massachusetts | Quabbin Reservoir | 4.21 | 24 |
| Ohio | Wooster | 4.21 | 24 |
| New York | West Point | 4.22 | 24 |
| Pennsylvania | Leading Ridge | 4.22 | 24 |
| Massachusetts | East | 4.23 | 22 |
| Tennessee | Walker Branch | 4.25 | 22 |
| New York | Knobit | 4.26 | 22 |
| Ohio | Oxford | 4.26 | 21 |
| Kentucky | Perryville | 4.27 | 21 |
| New York | Jasper | 4.27 | 21 |
| Maryland | White Rock | 4.28 | 21 |
| Ohio | Delaware | 4.28 | 21 |
| Kentucky | Clark State Fish H. | 4.29 | 20 |

1985 Annual Data Summary
Derived from the Acid Deposition System (ADS) Data Base

pH (lab)

| State<br>Network<br>Site Name | Wtd Mean | Min |
|---|---|---|
| Hawaii | | |
| NADP/NTN | | |
| Mauna Loa | 4.95 | 3.39 |
| Idaho | | |
| NADP/NTN | | |
| Craters of Moon | 5.56 | 5.21 |
| Headquarters | 5.26 | 4.89 |
| Reynolds Creek | 5.56 | 5.18 |
| Smiths Ferry | 5.41 | 5.01 |
| Illinois | | |
| NADP/NTN | | |
| Argonne | 4.35 | 3.65 |
| Bondville | 4.34 | 3.97 |
| Dixon Springs | 4.37 | 4.01 |
| Monmouth | 4.58 | 3.94 |
| Salem | 4.34 | 3.94 |
| Shabbona | 4.44 | 3.88 |
| Southern Ill U | 4.40 | 4.02 |
| Indiana | | |
| NADP/NTN | | |
| Huntington | 4.41 | 3.90 |
| Indiana Dunes | 4.41 | 3.38 |
| Purdue U Ag Farm | 4.32 | 3.78 |
| Southwest Purdue | 4.31 | 3.90 |
| Iowa | | |
| NADP/NTN | | |
| Big Springs Fish H | 4.98 | 4.09 |
| McNay Research Sta | 4.81 | 4.36 |
| Kansas | | |
| NADP/NTN | | |
| Farlington | 4.71 | 4.21 |
| Konza Prairie | 4.94 | 4.21 |
| Scott Lake | 5.58 | 4.93 |
| Kentucky | | |
| NADP/NTN | | |
| Clark State Fish H | 4.29 | 3.72 |
| Land Between the L | 4.43 | 3.50 |
| Lilley Cornett Woo | 4.37 | 3.85 |
| Perryville | 4.27 | 3.83 |
| Louisiana | | |
| NADP/NTN | | |
| Iberia | 4.79 | 4.04 |
| N La Hill Farm | 4.73 | 3.84 |
| Southeast | 4.85 | 4.42 |
| Maine | | |
| NADP/NTN | | |
| Acadia > 11/81 | 4.39 | 3.81 |
| Bridgton | 4.37 | 3.73 |
| Caribou (a) | 4.47 | 3.72 |
| Greenville Station | 4.50 | 3.91 |
| Presque Isle | 4.48 | 3.80 |

United States Department of the Interior
NATIONAL PARK SERVICE
INDIANA DUNES NATIONAL LAKESHORE
1100 N. MINERAL SPRINGS ROAD
PORTER, INDIANA 46304

IN REPLY REFER TO:

N3615(INDU)

July 2, 1987

Mrs. Charlotte Read
Save the Dunes Council
P.O. Box 114
Beverly Shores, Indiana 46301

Dear Charlotte:

As requested in our phone conversation on June 20, 1987, I am providing information on what is known of $SO_2$ damage to natural resources within the lakeshore.

Studies have been conducted over the last several years which addressed symptoms of air pollution injury to various vegetation. Thomas Armentano, et al. of Butler University conducted a survey of air-pollution-sensitive vegetation in 1984. The study concentrated on jack pine and white pine. Visible pollution injury in needles of both pines appeared widely throughout the lakeshore. Symptoms are recognized as stress responses to ozone and sulfur dioxide. It was further suggested that the lack of reproduction in white pine may be due in a large part to high ozone levels. Pollutent effects were somewhat greater in the eastern end of the lakeshore. In addition, based upon previous studies in other areas, plants known to be sensitive to ozone and sulfur dioxide were also surveyed. Thirty-four of the 56 species scored for pollutent symptoms were found to be sensitive to very sensitive to high sulfur dioxide levels.

Another group of plants, the lichens, are known to be very sensitive to high sulfur dioxide and thus are often used as bioindicators of pollution. Clifford Wetmore of the University of Minnesota conducted a study of lichens and air quality in the lakeshore in 1986. He assessed lichen diversity, abundance, and health. He compared what he found to a lichen flora of Chicago and vicinity done by Calkins in 1896 and to lists of lichens known to be sensitive/tolerant to sulfur dioxide. He found only 17% of the lichens reported by Calkins to still exist in the lakeshore. Also, most of the species still present have been demonstrated to be sulfur dioxide tolerant. Lichens present were often in poor health with no sexual structures present. Although this study does not prove that air pollution is the only factor responsible for the drastic reduction in the lichen flora, it is good circumstantial evidence. He did not find an east-west gradient in the lakeshore.

Based upon this information and the lakeshore's mandate to preserve the significant natural resources, it is obvious that any increase in sulfur dioxide levels in the area are undesirable.

You also asked about the availability of wind direction and speed records from the lakeshore or some area closer than Flint, Michigan. We do not have such records from the lakeshore. According to Lou Brenan, Flint, Michigan is the closest official recording station to Michigan City. However, he indicated that NIPSCO has been recording this data in the four cardinal directions from each of their power plants for some years. The model of plume dispersion maybe should be based upon data from the Michigan City stations.

I hope this information fulfills your needs. If I can be of any further assistance, please do not hesitate to ask.

Sincerely,

Ron Hiebert, Ph.D.
Chief, Division of Science

cc:
Dale Engquist, Supt., INDU

# Overview of Air Pollution Effects On National Parks Vegetation in 1985

By James P. Bennett
NPS Air Quality Division

**Known Air Pollution Effects on Vegetation in National Parks – 1985**

| Park | Pollutant | Vegetation Effects |
|---|---|---|
| Acadia NP | Ozone (Four exceedances of NAAQS* in 1983 & 1984; the maximum hourly average during these years has been 0 14 ppm.) | Over 95% of 300 eastern white pine trees studied in 1984 showed some slight injury. Almost 30% of the injury was 20% foliar damage or greater The injury appears to be correlated with decreased width of tree rings, i.e. growth. |
| Shenandoah NP | Ozone (No exceedances of NAAQS since 1980. However, maximum hourly averages during summers reach as high as 0.12 ppm; monthly means are increasing by .003 ppm.) | Widespread foliar injury in 1982 & 1984 on white pine, tulip poplar, black locust, wild grape, clematis and milkweed. Injury on the most sensitive species (milkweek) occurred on 90% of the plants observed each year. About 8% of the least sensitive species (black locust) were injured. The injury appears to be correlated with decreased productivity and plant diversity. Tree mortality is abnormally high |
| Shenandoah NP | Sulfur oxides and heavy metals (Levels of $SO_2$ are about 20% of the 3 hour NAAQS and 30% of the 24 hour NAAQS.). | Elevated concentrations of sulfur and lead are found in lichens. At some sites, the concentrations are above the normal range for lichens from unpolluted areas. Such concentrations have been associated with lichen decline and food web effects in other studies. |
| Great Smoky Mountains NP | Ozone (Data collected by TVA show numerous exceedances of NAAQS; however, latest data collected by Tennessee show attainment of NAAOS.) | Between 25-30% of eastern white pine trees show injury. Preliminary evidence indicates that sensitive genotypes may be disappearing and that growth is decreasing |
| Saguaro NM | Ozone (No exceedances of NAAQS since 1982; hourly average has reached .110 ppm during the summer.) | Almost all of 225 ponderosa pine trees studied in 1984 showed some injury, with the everage foliar injury being almost 12%. Some slight injury was also observed on oak and walnut trees. |
| Sequoia NP | Ozone (The maximum hourly average during the summer has consistently exceed or equalled NAAQS since 1981.) | Over one-third (36%) of 540 ponderosa pine trees studied periodically since 1980 show moderate to severe injury. Injury is also common on oak trees. Foliar symptoms, like ozone injury observed in laboratory studies, have been recently observed on giant sequoia seedlings in the park. |
| Santa Monica Mountains NRA | Ozone and Sulfur Dioxide (Summer 1984 ozone levels exceeded NAAOS on numerous occasions with the highest hourly average being 0.22 ppm.) | Air pollution injury averaged 40% of all injury on 7 species. The injury has been related to reduced biomass production and subsequent soil destabilization and fire fuel loading. In portions of the park lichens are no longer found, indicating long-term exposures to $SO_2$. |
| Indiana Dunes NL | Ozone and Sulfur Dioxide (Numerous exceedances of ozone NAAQS in recent years; highest $O_3$ hourly average recorded has been 0.16 ppm, $SO_2$ concentrations are 73%, 64% & 47% of 3 hour, 24 hour, and annual NAAQS.) | Foliar injury is common on 16 species studied in 1984 including white and jack pines. Injury is greater on juveniles than adults. Growth of jack pine juveniles and white pine adults is reduced in areas highest in ozone. Lichens are also no longer found here, indicating long-term exposures to $SO_2$. |
| Cuyahoga Valley NRA, Saratoga NHP & Acadia NP | Ozone | In a common fumigation exposure study, injury on quaking aspen genotypes from these parks was significantly less than injury on aspen genotypes from Voyageurs & Isle Royale NPs, indicating that sensitive genotypes are absent and that the species gene pool is affected. |

*National Ambient Air Quality Standards (NAAQS).
Ozone: 0.12 ppm/1 hour/1 day
Sulfur Dioxide: 0.50 ppm/3 hour, 0.14 ppm/24 hour; 0.03 ppm/annual average
All reported values are from NPS monitors physically located in National Parks.

Four years ago I initiated the Biological Effects Program for the Air Quality Division by starting a number of projects for detecting effects (*Park Science* 2. 10). Enough time has passed since the program's inception to begin summarizing some of the findings The accompanying table summarizes known biological effects from field studies in about 10 national park units, and biomonitoring results in many more parks. The three columns name the parks containing the effects, the pollutants causing the effects and recent observed concentrations, and the effects themselves

Observing effects of pollutants on plants accomplished two purposes: biomonitoring of the presence of pollutants, and translating this into actual biological effects. Most air pollutants cause specific types of foliar injury which can be diagnosed in the field the types of spots on the leaves can tell you which pollutants were present and which caused the injury Thus, identification of these spots is one means of monitoring the presence of pollutants

In addition, however, the injury itself is a biological effect. The pollutants were present at concentrations high enough to affect cells in obvious ways. For example, ozone concentrations above 0.08 ppm cause a dark purple stippling on the top surfaces of leaves. Each stipple, or spot, is actually a dead cell. If enough of this type of injury occurs, it usually means that less obvious but more serious effects also are taking place. Such effects include growth reductions, premature leaf abscission, reduced flowering, decreased fruit weights, end more. These are the types of effects described in one part of the table, while biomonitoring results appear in the other part.

It is clear from the table that the worst effects in the national parks are the results of elevated levels of ozone. This pollutant is widespread in the eastern U.S. and California. Our milkweed survey indicates that ozone is present in at least 20 parks in the eastern U.S. at concentrations above the foliar injury threshold for this species (about 0.06 ppm). The same might be said for California since ponderosa pine also is sensitive to ozone at about this concentration.

The next important air pollutant in the national parks from the point of view of biological effects is actually a whole class of pollutants – the heavy metals. Elevated levels of lead are common in organisms in several parks, probably due to the lead in automobile emissions.

This table only summarizes what is known about existing effects found in field studies on terrestrial vegetation from gaseous and particulate air pollutants, and specifically excludes terrestrial and aquatic effects from acidic precipitation. The effects of acid rain on high-elevation eastern forests is greatly talked about today, but very little is actually known about it. Many studies are underway in several eastern parks to establish clear cause and effect relationships for acid raid

The worst effects are not found in the parks that are designated Class I under the Clean Air Act. Instead, Indiana Dunes and Santa Monica Mountains, both Class II parks, show severe effects but have a lesser degree of protection under the act. They do indicate, however, that severe effects could occur in

# research notes

***Editor's Note:*** *Beginning with this issue,* Park Science *will be devoting a specially designated space to research projects contemplated or recently underway. The new section, entitled* ***Research Notes,*** *was suggested by Editorial Board Member Gary Davis in the interest of promoting better communication among scientists about research that is in the planning stage or still is being conducted.*

*Davis proposes that* ***Research Notes*** *might also make available space for those who wish to propose a research topic or who are asking for assistance in obtaining ideas, methods, literature, study sites, or whatever, for a particular project. For instance, Davis and William L. Halvorson, a research biologist at Channel Islands National Park, are considering writing a review article about long-term research in National Parks and would be interested in receiving information for such an article. Readers able to shed light, furnish answers, or otherwise respond to the information given or requested in the* ***Research Notes*** *space would respond directly to the individual who placed the Note. In this way, information asked, offered, given, and received will get fastest and widest circulation.*

## Erosion on Santa Barbara Island

Erosion is a serious problem on Santa Barbara Island, the smallest 260 hectares (or 642 acres) of the Channel Islands off the coast of southern California. For approximately 80 years prior to its becoming part of Channel Islands National Monument in 1938, the island was heavily impaced by sheep, goats, rabbits, cats, farming (including plowing and burning) and the introduction of exotic plant species. Since 1980 when Channel Islands National Park was created, the NPS has been conducting an extensive inventory and monitoring program.

One aspect of the research/management program is a study of the erosion on Santa Barbara Island; its causes and feasible cures. Because of past land-use practices, the island vegetation is now primarily an exotic-species dominated grassland and interspersed with patches of shrubs, both native and exotic. These patches vary in size and density throughout the island, but both aspects are increasing now that the grazers have been removed from the island (rabbits were present until 1981). The erosion apparently was caused by a combination of the change from native vegetation cover to exotic species brought about by farming, and the burrowing rabbits, that caused further reductions of plant covering on the soil.

The island soils are primarily heavy clay vertisols and mollisols, which exhibit fairly strong shrink-swell characteristics. Burrowing and denuding of the area served to increase the soil's tendency toward tunnel erosion. The result has been an extensive pattern of gullies with occasional patches (up to 2.7 hectares or 6.6 acres) of sheet erosion where the top soil has been completely removed.

This study is a joint effort on the part of Bill Halvorson (Channel Islands NP), Denny Fenn (CPSU, Texas A&M), and Lynn Whittig (UC-Davis). It includes analyses of the specific characteristics of the soil and of vegetation, and germination and growth experiments using indiginous seeds. The concern is that the Park be able to amend the soil by changing nutrient content, structure, and/or organic matter content as needed, and that a ground cover of native species be restored, all without introducing any new gene pools to the island. Understanding the soil-vegetation interrelationships will greatly enhance our ability to solve the erosion problem, and also will aid in our attempts to restore to the greatest extent possible, the native plant and animal communities of the island.

*CONTACT:* Gary Davis, Channel Islands NP, 1901 Spinnaker Dr., Ventura, CA 93001.

## Dudleya traskiae

Channel Islands National Park currently is studying what appears to be a success story involving the Endangered Species Act. The Santa Barbara Island live-forever, *Dudleya traskiae* (Rose) Moran, is a succulent, perennial plant whose natural distribution is limited to Santa Barbara Island. It was listed as Endangered by the U.S. Fish and Wildlife Service (USFWS) in April 1978 (FR 43 17916). This status was deemed appropriate based on the fact that the past land-use practices, including farming, burning, and introduction of rabbits, had reduced the presence of *Dudleya traskiae* to such an extent that in 1970 it was thought to be extinct in the wild; however, it was rediscovered in 1975 as one population of a few individuals.

The NPS, meanwhile, had initiated an intensive effort to irradicate the rabbits, which were the primary cause of the near demise of a number of native plant species on the island. Complete removal of the rabbits was accomplished in 1981. Following that, Park personnel conducted surveys for the live-forever in 1982, 1983, and 1984. These surveys indicated a trend of increasing numbers and range for the species, which is still restricted to rocky sea and canyon bluffs of moderate to vertical slope.

In late 1984, while the USFWS's recovery plan was undergoing final review, a study of the population dynamics and habitat requirements of *Dudleya traskiae* was initiated by Bill Halvorson and Ronilee Fowler of Channel Islands. Support for the study has come from the USFWS and the State of California Dept. of Fish and Game's Endangered Species Program in the form of botanists giving their time in consultation and in partial funding of the research. The study will map populations and individuals, record habitat characteristics, and determine population dynamics for this species.

This information was not available for inclusion in the recovery plan and therefore will be essential to the carrying out of the plan's objective to restore the Santa Barbara Island live-forever to 95 percent of the suitable potential habitat with vigorous and self-sustaining populations. Though it appears to be expanding again, the successful long-term management of this extremely rare species requires the completion of this coordinated, jointly-funded research effort. Upon completion we're hoping to show not only successful recovery of an endangered species, but a successful venture into three-way interagency cooperation.

*CONTACT:* Bill Halvorson, Channel Islands NP, 1901 Spinnaker Dr., Ventura, CA 93001.

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the Class I parks if pollutant concentrations are allowed to reach the levels found in INDU and SOMO.

Our most important study is that mentioned in the last entry in the "effects" table. This study compares the sensitivities of different genotypes of the same hardwood tree species from many different eastern parks. Evidence being analyzed indicates that the genotypes from the more polluted parks are less sensitive than those from more pristine parks. This indicates that selection is favoring tolerant genotypes and that sensitive ones are being removed from the existing populations. This is extremely important for natural resource managers in the parks to know because it indicates that the natural gene pools are being diminished. Thus, fitness of species is lowered; the whole fabric of natural ecosystems can unravel should this continue.

**Biomonitoring**

* The following parks are either exhibiting elevated concentrations of the indicated elements in biosphere organisms or components, or frequent foliar injury from gaseous pollutants. The ecological significance of this is unknown but it does indicate anthropogenic influences are presented.

| Park | Pollutant | Biosphere Organism or Component |
|---|---|---|
| 20 Eastern Parks | Ozone | Common milkweed: foliar injury. |
| Hampton NHS<br>Gettysburg NMP<br>Fredericksburg/<br>Spotsylvania NMP<br>Petersburg NB | Ozone | Black cherry, white ash, wild grape, sassafras, tulip poplar, dogwood, milkweed, witchhazel, redbud, white pine, Austrian pine: foliar injury. |
| Isle Royale NP<br>Theodore Roosevelt NP<br>Everglades NP<br>Shenandoah NP<br>Great Smoky Mountains NP | Sulfur | Lichens: abnormally high concentrations. |
| Shenandoah NP | Lead | Lichens: abnormally high concentrations. |
| Great Smoky Mountains NP | Lead | Leaf litter: abnormally high concentrations. |
| Big Thicket NP | Sulfur, heavy metals | Spanish moss: abnormally high concentrations. |
| Mt. Rainier NP | Arsenic | Subalpine fir foliage: abnormally high concentrations. |
| Great Smoky Mountains NP | Heavy metals | Red spruce: abnormally high concentrations in tree rings. |

EST. 1986

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
NANCY A. MALOLEY, Commissioner

105 South Meridian Street
P.O. Box 6015
Indianapolis 46206-6015
Telephone 317-232-8603

June 16, 1988

Mr. C.W. Kern, Manager
Environmental Affairs
Northern Indiana Public Service Company
5265 Hohman Avenue
Hammond, Indiana 46320

Dear Mr. Kern:

Enclosed is correspondence received from Save the Dunes Council concerning material damage possibly attributable to particulate emissions from your Michigan City plant. It is our understanding that this problem occurs during Unit 12 start-ups after the unit has been down for at least two or three days. During the initial period of start-up when the unit is on gas and the ESP is in service, the hot flue gases heat the cold ductwork (between the ESP and the stack) and the stack liner. As the metal heats and expands, material that has built up or is loose on the metal surfaces flakes off and is carried out by the flue gas. The relatively large sized material settles quickly after leaving the stack. Material is part fly ash and iron rust material from the ductwork and the stack liner. [redacted]

It is our understanding that NIPSCo's standard procedure now is to avoid, whenever possible, starting Unit 12 up when the wind is from the west and to wait until the wind direction carries the emissions out over the lake. Although cold start-up is infrequent (one to four times per year), any such incident is of concern. Emissions or excess opacity start-up operations are likely exempt from Air Pollution Control Board (APCB) rules. However, damage attributable to air pollution cannot be tolerated.

Therefore, our office requests that NIPSCo contact the Office of Air Management twenty-four hours prior to start-up from cold shutdown of Unit 12. Such notice will allow observation of emissions and meteorological conditions during Unit 12 start-up. Obviously, a continuing problem will require our office to take appropriate action either through enforcement of existing APCB rules if possible or through development of a source-specific requirement to alleviate the problem. I am confident that we can work together to correct this problem.

If there are any questions on this matter, please contact David Zell (317) 232-8456 or Dan Hancock (317) 232-8429 of my staff.

Sincerely,

Thomas W Rarick

Thomas W. Rarick
Assistant Commissioner
Office of Air Management

TJM/sdp
Enclosure
cc: Charlotte Read, Save the Dunes Council ✓

TR

Save the Dunes Council

ORGANIZED IN 1952

P.O. BOX 114 • BEVERLY SHORES, INDIANA 46301 • TELEPHONE 219/879-3937 OR 926-2224

May 23, 1988

RECEIVED
MAY [illegible]
State of Indiana
Department of Environmental Management
[illegible]

Mr. Thomas Rarick, Assistant Commissioner
OFfice of Air Management
Indiana Department of Environmental Management
105 South Meridian
P.O. Box 6015
Indianapolis, IN 46206-6015

Dear Mr. Rarick:

As you may know, the Save the Dunes Council is very concerned about the control of air pollution in the three counties along Lake MIchigan -- Lake, Porter, and LaPorte. Last year, the Council objected strenuously to the proposed revision of the SO2 rule for LaPorte County, since it allows NIPSCO to burn higher sulfur content coal in their Unit No. 12 in MIchigan City. We also raised the issue of the localized acid rain effect of the tall Unit No. 12 stack when combined with the NIPSCO cooling tower. The lake effect which we believe is another factor in localized impact also was not considered in developing the SO2 rule.

Enclosed is correspondence from the President of the MIchigan City Historical Society Inc. which is housed in the Old LIghthouse Museum. The building is downdrift (or downwind) of the NIPSCO Michigan City complex. The current air quality standards are insufficient to protect the Old Lighthouse Museum from physical damage. The Council is rightly concerned that the situation is likely to be even worse when the revised SO2 rule goes into effect.

The Museum has had a long history of problems with the fallout from the NIPSCO plant. These problems continue. Why?

A building on the National REgister of Historic Places occupies a favored place in our nation's cultural history. The air quality standards are designed to protect physical features in addition to being designed to protect the public health. Obviously, in Michigan City, the Old LIghthouse Museum is being victimized by air pollution.

It is well known here in MIchigan City that the boaters have consistently complained and been compensated for the damage to their boats caused by NIPSCO. Now, we know that buildings are also being affected. Yet, no long term solution seems to be on the horizon.

I have enclosed a map of the Michigan City lakefront, highlighting the NIPSCO electric generating complex, the Old LIghthouse Museum, and the Washington Park Marina Basin. It should be noted that boats are docked along Trail Creek up to the "E" Street bridge, also highlighted.

Something is wrong with the air quality standards for MIchigan City or with the enforcement of these standards.

On behalf of the Save the Dunes Council, the Lighthouse Museum, and the concerned citizens of Michigan City, I hope you will investigate this intolerable situation and find and implement a permenent solution.

Sincerely,

Charlotte J. Read

Charlotte J. Read
Executive Director
SAVE THE DUNES COUNCIL INC.

encl: May 20, 1988 letter to me from President, Old Lighthouse Museum
March 25, 1988 letter to President, Old LIghthouse Museum, from NIPSCO
March 7, 1988 letter to NIPSCO from President, Old LIghthouse Museum
March 15, 1988 letter to Crawford and Company from Curator, Old LIghthouse Museum
Map, Michigan City Lakefront

cc: Tim Method, Office of Air Management, IDEM
President, Old LIghthouse Museum
Division of Historic Preservation and Archaeology, Indiana Department of Natural Resources
Indiana Coordinator, National Park Service (DAle Engquist, Superintendent, Indiana Dunes National Lakeshore)

News Dispatch
Michigan City, IN
May 17, 1982

# NIPSCO stack fallout discussed

**Port Authority member Norman Cipares last night reported a successful meeting about fallout from Northern Indiana Public Service Co. smokestacks.**

**Cipares met Sunday with the Washington Park Marina Dock Committee, made up of slip-holders, and heard from officials of NIPSCO about the fallout. The group will make site reports on smokestack discharge, and NIPSCO will send experts to investigate in an effort to cut damage to boat decks caused by chemicals from stack emissions.**

In other business:

—Member Warren Sherwood asked that water service be extended to the slip area at Sprague Marina. He will work toward that end with members Hartley Job and James Kruse.

—Job reported on a meeting with officials of the Ferry Sloop Project, which will sponsor a lakefront program on the environment in the Municipal Dock area July 16-17. The project will include entertainment and a display of historic wooden boats. Job, Cipares and Stanley Przybylinski urged authority support for the program. The board tentatively approved plans, pending a final proposal.

—Members adopted Job's motion that parking be limited to automobiles only along the north side of the roadway from the southeast corner of the yacht basin to the U.S. Coast Guard station. Job said vans and trucks parked in that area had obstructed the view of the basin for people driving through Washington Park.

—Chairman Al Spiers reported that the Indiana Department of Natural Resources is completing a plan for DNR participation in developing the NIPSCO west property and the former Cargill land east of the generating station, on the harbor's south side. Only minor matters remain to be settled before NIPSCO issues a license for the authority to use the west bank, Spiers said.

—Authority Superintendent Lew Timberlake reported that 18 spaces are available in the dry-stack storage facility at Sprague Marina for boats up to 17 feet long.

—Sherwood asked members to consider buying a 200-amp portable welding unit for general maintenance of Port Authority facilities, and for construction of floating docks, should the authority itself decide to construct the docks. Charter captain Mort Kaplan told members he would donate 55-gallon drums if they could be used in the dock construction.

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Wednesday, September 7, 1983 The News-Dispatch. Michigan City, IN. 7

# Park Board, Port Authority to discuss boat show dispute

Mayor Clifford Arnold will act as mediator in a Washington Park parking dispute between the Parks and Recreation Board and Port Authority, members of the Authority learned last night.

Arnold asked for a meeting at 9 a.m. Sept. 27 in his office with representatives of the Authority, Park Board and Order of DeMolay to discuss the dispute.

DeMolay members had handled parking for the recent In-Water Boat Show. During the show, a rift developed between the two boards.

The basis for the dispute involved use of the grassy area around the Yacht Club, which is Park Department property. The Port Authority asked to use the area for parking for the boat show as it had in the past. The Park Board said it could, but with certain stipulations.

The board also wanted to meet with the Authority to work out arrangements. No meeting took place.

The Authority used the area for parking and the Park Board complained it was used improperly. Some Park Board members say they plan to send a bill to the Authority for damages to the grassy area caused by parking.

In a letter read at last night's Authority meeting, the mayor said he was deeply concerned over newspaper and radio reports of the difficulties between the two boards.

"It is my feeling that the In-Water Boat Show and other activities that take place on our lakefront are good for the community and must be given the utmost of cooperation between all parties and boards concerned.

"While I realize that there are difficulties that will arise, they certainly should be able to be talked out in a very businesslike and efficient manner," the mayor wrote.

Authority Chairman Warren Sherwood appointed board members Hartley Job and Norman Cipares to represent the board at the meeeting. A copy of the mayor's letter also was delivered to DeMolay representative Jon Bausback.

Also last night, Authority member Al Spiers reported on a recent meeting with NIPSCO officials and said he believed NIPSCO had done all it could to control smoke stack emmissions. Material spewn from the stacks poses a continuing problem for boaters in Washington Park Marina because it damages decks.

# Coal, Origin, and Destination Data

## Table 59. Origin of Coal Received at Electric Utilities for Steam Plants of 50-Megawatt Installed Nameplate Capacity or Larger, by Company and Plant, 1984—Continued

| Company Plant<br>Origin State<br>County | | Quantity (thousand short tons) | Average Quality | | | Average Cost Delivered | |
|---|---|---|---|---|---|---|---|
| | | | Btu per Pound | Sulfur Percent by Weight | Ash Percent by Weight | Cents per Million Btu | Dollars per Short Ton |
| **Niagra-Mohawk Power** | **Dunkirk** | | | | | | |
| West Virginia | | 64.0 | 12,943 | 2.32 | 9.55 | 156.3 | 43.05 |
| Marion | | 7.0 | 12,579 | 2.21 | 11.00 | 156.4 | 39.35 |
| Monongalia | | 57.0 | 12,987 | 2.34 | 9.38 | 167.5 | 43.51 |
| **Niagra-Mohawk Power** | **Huntley** | 1,978.0 | 12,973 | 1.60 | 8.48 | 202.1 | 52.44 |
| Kentucky | | 351.0 | 13,040 | 1.33 | 5.86 | 248.9 | 64.90 |
| Knox | | 351.0 | 13,040 | 1.33 | 5.86 | 248.9 | 64.90 |
| Ohio | | 14.0 | 13,172 | 1.62 | 7.45 | 183.7 | 48.39 |
| Columbiana | | 14.0 | 13,172 | 1.62 | 7.45 | 183.7 | 48.39 |
| Pennsylvania | | 1,562.0 | 12,950 | 1.68 | 8.08 | 192.4 | 49.84 |
| Armstrong | | 153.0 | 12,571 | 1.67 | 10.63 | 193.9 | 48.76 |
| Butler | | 2.0 | 12,397 | 1.59 | 9.20 | 174.9 | 43.38 |
| Clearfield | | 68.0 | 12,900 | 1.42 | 9.88 | 174.7 | 45.08 |
| Elk | | 137.0 | 12,804 | 1.96 | 9.40 | 179.5 | 45.96 |
| Fayette | | 68.0 | 12,877 | 1.63 | 9.40 | 170.9 | 44.02 |
| Greene | | 127.0 | 13,312 | 1.77 | 6.63 | 170.0 | 45.28 |
| Jefferson | | 1,002.0 | 12,996 | 1.65 | 8.00 | 199.8 | 51.87 |
| Washington | | 7.0 | 12,168 | 1.96 | 11.20 | 186.3 | 45.34 |
| West Virginia | | 51.0 | 13,168 | .94 | 8.55 | 179.8 | 47.36 |
| Marion | | 5.0 | 12,815 | 1.66 | 9.30 | 179.7 | 46.08 |
| Webster | | 46.0 | 13,206 | .88 | 8.47 | 179.8 | 47.50 |
| **Northern Indiana Public Service** | **Bailly** | 1,169.7 | 11,009 | 3.21 | 10.04 | 191.1 | 42.07 |
| Illinois | | 945.1 | 10,961 | 3.13 | 10.26 | 186.3 | 40.63 |
| Douglas | | 51.3 | 10,726 | 3.05 | 10.15 | 208.7 | 44.79 |
| Franklin | | 80.1 | 11,601 | 2.18 | 8.36 | 173.8 | 40.32 |
| Perry | | 708.0 | 10,903 | 3.27 | 10.55 | 182.2 | 39.74 |
| Randolph | | 105.7 | 10,979 | 3.03 | 9.61 | 212.4 | 46.63 |
| Indiana | | 192.7 | 11,235 | 4.01 | 9.63 | 188.2 | 42.28 |
| Daviess | | 13.8 | 10,800 | 2.90 | 12.00 | 203.6 | 43.98 |
| Knox | | 14.1 | 10,900 | 2.80 | 10.00 | 173.1 | 37.74 |
| Pike | | 165.0 | 11,300 | 4.20 | 9.40 | 188.2 | 42.53 |
| Wyoming | | 31.9 | 11,067 | .52 | 5.90 | 350.1 | 77.50 |
| Carbon | | 31.9 | 11,067 | .52 | 5.90 | 350.1 | 77.50 |
| **Northern Indiana Public Service** | **Michigan City** | 1,807.6 | 10,967 | 2.89 | 9.81 | 201.8 | 44.22 |
| Illinois | | 1,271.9 | 10,920 | 2.87 | 10.20 | 198.3 | 43.30 |
| Douglas | | 709.3 | 10,696 | 3.03 | 10.83 | 203.8 | 43.61 |
| Franklin | | 262.4 | 11,572 | 2.29 | 9.25 | 173.0 | 40.04 |
| Perry | | 9.6 | 10,944 | 3.27 | 10.20 | 218.4 | 47.80 |
| Randolph | | 290.8 | 10,670 | 2.99 | 10.17 | 208.5 | 45.34 |
| Indiana | | 267.7 | 11,162 | 3.59 | 9.62 | 179.9 | 40.17 |
| Daviess | | 10.1 | 11,300 | 2.80 | 10.00 | 161.4 | 36.48 |
| Knox | | 103.2 | 10,943 | 2.76 | 9.82 | 173.4 | 37.95 |
| Pike | | 154.4 | 11,300 | 4.20 | 9.40 | 185.4 | 41.89 |
| Wyoming | | 68.0 | 11,090 | .52 | 5.68 | 349.3 | 77.48 |
| Carbon | | 68.0 | 11,090 | .52 | 5.68 | 349.3 | 77.48 |
| **Northern Indiana Public Service** | **Mitchell** | 786.7 | 11,102 | .52 | 5.64 | 360.9 | 80.13 |
| Wyoming | | 786.7 | 11,102 | .52 | 5.64 | 360.9 | 80.13 |
| Carbon | | 786.7 | 11,102 | .52 | 5.64 | 360.9 | 80.13 |
| **Northern Indiana Public Service** | **Rollin Schahfer** | 2,258.6 | 11,107 | 1.79 | 9.30 | 250.5 | 55.64 |
| Colorado | | 711.9 | 11,415 | .49 | 9.34 | 294.9 | 67.33 |
| Delta | | 711.9 | 11,415 | .49 | 9.34 | 294.9 | 67.33 |
| Illinois | | 1,028.2 | 10,833 | 3.28 | 10.91 | 187.8 | 40.68 |
| Perry | | 998.9 | 10,831 | 3.28 | 10.89 | 187.2 | 40.56 |
| Randolph | | 29.3 | 10,903 | 3.36 | 11.54 | 205.9 | 44.91 |
| Indiana | | 29.4 | 10,800 | 2.90 | 12.00 | 214.8 | 46.40 |
| Daviess | | 29.4 | 10,800 | 2.90 | 12.00 | 214.8 | 46.40 |
| New Mexico | | 58.6 | 12,500 | .60 | 5.00 | 252.2 | 63.05 |
| Colfax | | 58.6 | 12,500 | .60 | 5.00 | 252.2 | 63.05 |
| Wyoming | | 430.7 | 11,085 | .52 | 5.62 | 323.1 | 71.64 |
| Carbon | | 430.7 | 11,085 | .52 | 5.62 | 323.1 | 71.64 |
| **Northern States Power** | **Black Dog** | 258.8 | 8,693 | .74 | 8.25 | 162.0 | 28.16 |
| Montana | | 232.3 | 8,676 | .77 | 9.74 | 163.5 | 28.36 |
| Big Horn | | 143.5 | 8,616 | .78 | 9.89 | 168.2 | 28.99 |
| Rosebud | | 88.8 | 8,773 | .80 | 9.49 | 155.9 | 27.35 |
| Wyoming | | 26.5 | 8,848 | .43 | 4.96 | 149.2 | 26.40 |
| Campbell | | 26.5 | 8,848 | .43 | 4.96 | 149.2 | 26.40 |
| **Northern States Power** | **High Bridge** | 86.1 | 8,662 | .68 | 8.20 | 164.6 | 28.84 |

Source: Federal Energy Regulatory Commission FERC Form 423, "Monthly Report of Cost and Quality of Fuels for Electric Plants."

# STATEMENT OF
# SOUTHERN INDIANA GAS AND ELECTRIC COMPANY

## SOUTHERN INDIANA GAS AND ELECTRIC COMPANY

Southern Indiana Gas and Electric Company (SIGECO) is appreciative of the opportunity to present testimony before the Subcommittee on Energy and Power regarding legislative proposals for acid precipitation reduction currently under consideration.

SIGECO is engaged in the generation, transmission, distribution, and sale of electricity in a Southwestern Indiana region of approximately 2,250 square miles, with a population of nearly 350,000. The Company is also engaged in the purchase, distribution and sale of natural gas in Evansville and 40 nearby communities and their environs.

To meet its electric power production requirements, SIGECO has an installed generating capacity of 1,032 megawatts of coal fired generation for base load production, and an additional 135 megawatts of gas/oil fired combustion turbine peaking units. In excess of 2 million tons per year of southern Indiana coal is presently consumed in the operation of these facilities. The effective and economical utilization of this fuel supply is being threatened by pending acid rain legislation which is not justified by the present body of knowledge.

Acid precipitation legislation is not warranted at this time because: 1) Significant improvements in air quality have been, and continue to be made under existing environmental control regulations. 2) The negative economic impact of accelerated reductions in emissions would be devastating. 3) The current body of scientific knowledge does not establish a need for accelerated emission reductions at this time. 4) Current research efforts will soon provide a more reliable scientific basis from which to make informed decisions regarding acid precipitation, and will also provide improved coal utilization technologies. These points are substantiated as follows.

## AIR QUALITY

The Clean Air Act of 1970 has been very effective in achieving health-based standards for air quality. Across the U.S. 98% of the counties now meet standards for $SO_2$ and $NO_x$, and there have been significant reductions in emissions while energy production and utilization has increased. SIGECO is no exception. In the short period from 1979 to 1987 SIGECO decreased $SO_2$ emissions rates by 28% while increasing electric power generation by 25%.

## IMPACT

Acid rain bills presently pending have a range of provisions, but all would require significant reductions of $SO_2$ emissions from our power plants under the premise that such reductions would result in reductions in the acidity of rain and the mitigation of any detrimental effects in certain sensitive regions. Any of these bills would have a major impact on our cost of operation. SIGECO has determined that such legislation would require both retrofit of some generating units with scrubbers and replacement of some older generating units. The estimated construction cost of this effort is approximately $400 million. In addition, annual operating and maintenance costs would be increased by approximately $30 million. These cost increases would necessitate an increase in the price our customers must pay for electrical energy by about 50%.

Similar increases in cost of electrical energy would be seen throughout the midwest, with substantial increases in the northeast and southeast as well. These increases in energy cost would result in significantly higher manufacturing costs and product prices, loss of competitiveness in the world marketplace, reduction in GNP, increased interest rates, reduction in housing starts and other negative impacts which would be devastating to our national economy. A National Association of Manufacturers study indicates a projected loss of 144,000 jobs in five midwestern states alone due to the impact threatened by acid rain legislation.

## CURRENT KNOWLEDGE

The interim report of the National Acid Precipitation Assessment Program (NAPAP) which was released in September, 1987, and represents a major assemblage of objective scientific knowledge on the acid precipitation issue to date, indicates that there are no health effects from acid rain, that further significant acidification of lakes in the northeast is unlikely to occur in the near future, and that air quality is improving under existing regulations. There is no pending crisis.

## RESEARCH

The NAPAP research effort is making significant progress toward developing a scientific understanding of the acid rain phenomenon. Interim findings indicate no urgency to take further action now. Certainly no action should be taken before the final assessment is available from that program in 1990.

Current research and development efforts on clean coal technologies are on the horizon of providing new methods for more cost effective utilization of coal while further reducing $SO_2$ and $NO_x$ emissions. Prudent judgement dictates that we continue to direct our resources toward development of these improved technologies rather than diverting them prematurely to currently available technologies which are less effective and much more costly.

## CONCLUSION

While we are committed to protecting the quality of our environment, we feel that enactment of acid rain legislation at this time is not prudent in light of the fact that air quality is improving under present regulations, the impact of such legislation at this time would be devastating to our national economy, and current scientific knowledge establishes no immediate need to take action.

Research has not to date demonstrated any cause-effect relationships between midwest sulfur emissions and the acidity of rain in the northeast and Canada. Neither is the impact of rain acidity on the environment understood to the extent that there is any confidence that a reduction in rain acidity would produce any significant beneficial results. Without the confidence that the associated increases in the cost of electricity and associated negative economic impacts would produce commensurate benefits in the improvement of the environment, we recommend that you do not support acid rain legislation. We do, however, recommend continued support for the vigorous research effort presently under way to develop an objective and sound technical basis on which to make responsible decisions in this important matter, and to develop improved coal utilization technologies.

June 11, 1988

The Honorable-Philip Sharp,
United States House of Representatives:
Dear Sir:

I am writing to you in regard to the hearing you are holding on June 20 to find out what Indiana citizens think of "Acid Rain". The evidence is overwhelming that acid rain harms the whole world around us in ways that translate into very real costs for all of us. Crop and forest damage is a deep concern to health problems caused by sulphur and nitrogen oxide pollution.

Acid Rain kills fish, stunts crop growth, and leaves dead and dying trees.

It is critical that you and others supporting the Clean Air turn out in force for the Indianapolis Hearing.

It is with deep regrets that I cannot be at the hearing personally. I am very much in favor of Clean Air and I marvel that we live as long as we do with such severe pollution. Please place my letter in the official hearing record. Urgent action is needed to be taken now, without further delay. Let's clean up acid rain pollution.

Sincerely,
Ann E. White
A very concerned
citizen of Indiana.

Mrs. H. H. White
519 Archer Avenue
Fort Wayne, In 46808

5733 Park Drive
Highland, Indiana
June 14, 1988

Dear Congressman Philip Sharp;

I'm aware that you will be in Indiana on June 20th in regard to acid rain. I will be unable to attend, but would like you to know I'm very interested in reducing the air pollution.

I live in one of the most industrial areas of Indiana. The lakes and waterways are polluted from industrial wastes. Some of the cars have emission tests and some do not. The farmers use pesticides and home owners use all kinds of sprays.

Many persons have respiratory problems. One can never see the stars anymore and I have personally lost six trees in the last decade!

I hope that you will be quite firm in your demands for improvement in spite of the opposition.

Sincerely,
Wanda Beck

ROBERT W. MELBYE
2932 SOUTH ELIZABETH
INDIANAPOLIS, INDIANA 46203

15 JUNE 1988

Hon.
Philip Sharp
US House Rep.
Washington D.C.

Dear Congressman Sharp. —

This is just a word to let you know I am behind you on the issue of "CLEAN AIR" - Acid Rain is killing our crops, our wildlife, and even our people — "Dirty" air (as you know) is responsible for lung diseases,

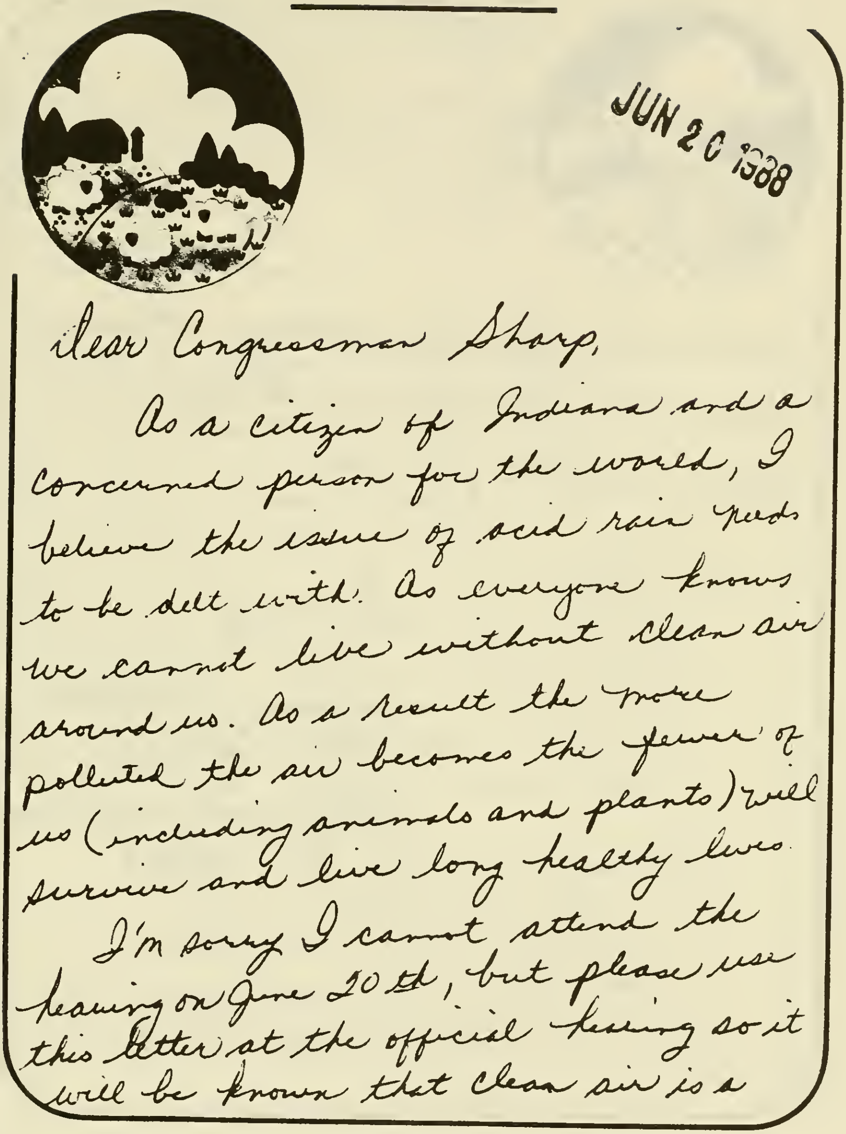
Robert W. Melbye
2932 south elizabeth
indianapolis, indiana 46203

(some lung diseases) and the acid rain is denuding our forests - I am sorry I ~~can~~ cannot attend your seminar in Indianapolis on 20 JUNE - But I am writing to you to let you know I am in full accord with all your efforts.

Good luck and may the Lord bless you in all your efforts—

Sincerely,

ROBERT W. MELBYE
USN (RET)

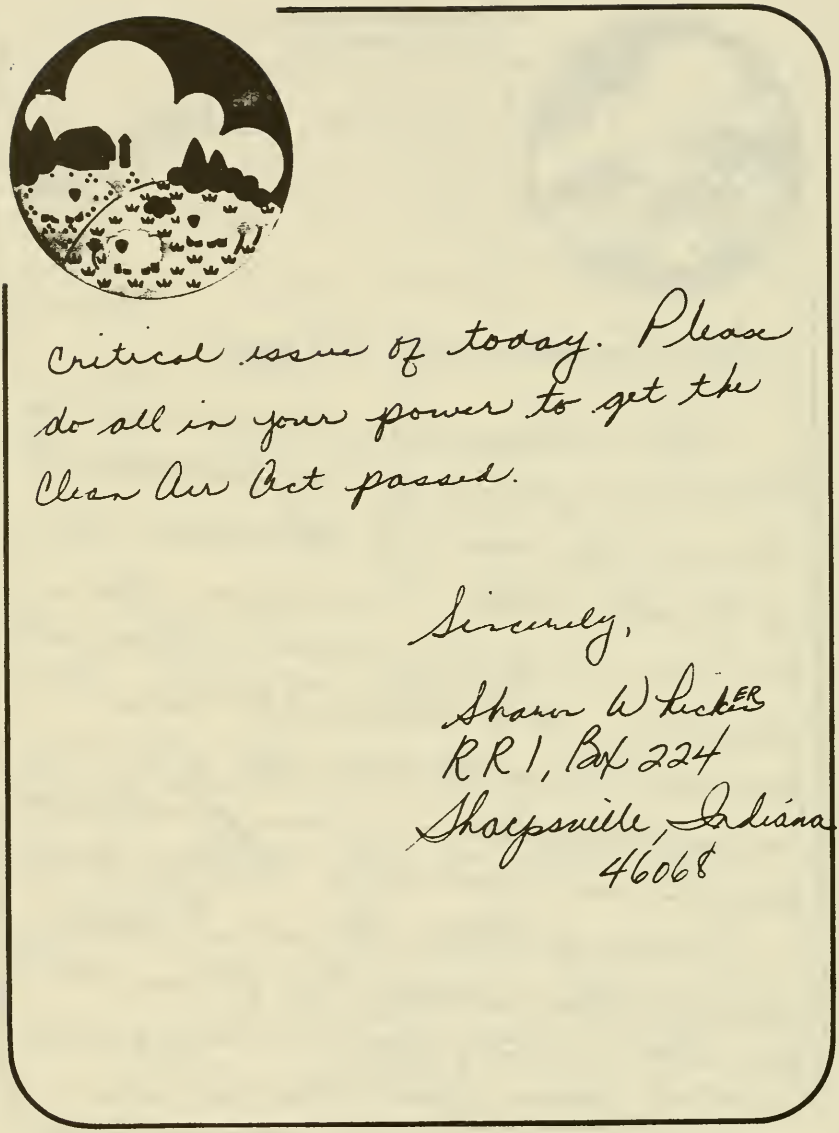


JUN 20 1988

Dear Congressman Sharp,

As a citizen of Indiana and a concerned person for the world, I believe the issue of acid rain needs to be delt with. As everyone knows we cannot live without clean air around us. As a result the more polluted the air becomes the fewer of us (including animals and plants) will survive and live long healthy lives.

I'm sorry I cannot attend the hearing on June 20th, but please use this letter at the official hearing so it will be known that clean air is a



critical issue of today. Please do all in your power to get the Clean Air Act passed.

Sincerely,

Sharon Whicker
RR1, Box 224
Sharpsville, Indiana
46068

Muncie, Indiana
June 13, 1988

The Honorable Philip Sharp
U.S. House of Representatives
2452 Rayburn House Office Bldg.
Washington, D.C. 20515

Dear Mr. Sharp:

Since we will not be able to attend the June 20 hearing in Indianapolis on the subject of acid rain we are writing to let you know we are among the many, many Hoosiers who are aware of the extreme importance of action being taken now for legislation to ensure Clean Air for our nation – and the world. We are particularly concerned about the problem + how it will effect the lives of our children and grandchildren.

Yours truly
Mr. & Mrs. Kenneth Hinshaw
1212 N. Jefferson St.
Muncie, In. 47303

We are asking that this letter be placed in the official hearing record

JUN 20 1988

Rep. Sharp 6-17-88

I recently heard of a hearing you will be holding on the 20th of this month in Indianapolis, to find out what the people of Indianas views are about acid rain.

Unfortunatly I and my family will not be able to attend this meeting. I am interested in knowing where you stand on this issue.

As a farming family and a nature conserver on our 103 acre farm in east Ind., we do not see this effect in this area, as of yet. But we know acid rain is a world-wide concern, that I personally think should be on the top of everyone's list. We cannot afford to let this get any worse then it has. Already its been proven;- 1 to 2 billion dollar losses in corn and soybean in the eastern area - heart and respiratory problems - severe damage is well on its way to Ind. Dunes Nat'l Seashore - with visable damage to the Jack and White pines there. The National Academy of Sciences says that the number of affected lakes nationwide will double by 1990.

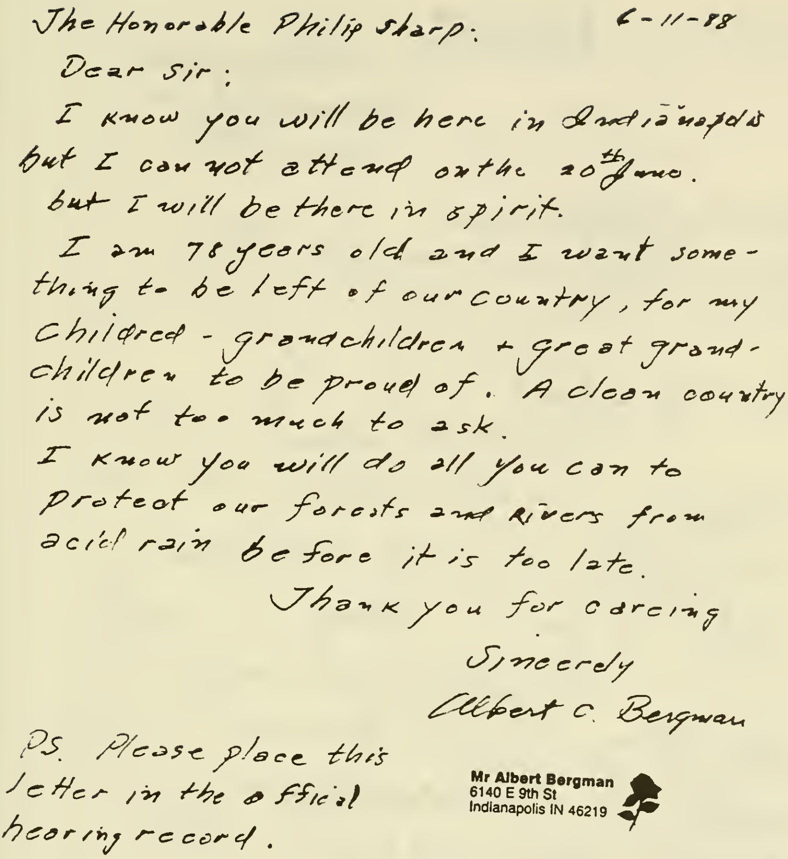
I think there must be a time - . Now - for us to push back the concern of MONEY and realize the damage that we are doing to this earth. Earth and nature cannot have a monetary value. All of us are concerned about our children and their children, and the future we are to leave them. If we don't take a firm stand on this Clean Air Act, ~~and~~ our future generations will be inheriting a toxic waste dump.

I know its hard to turn your back on the powerful lobbying forces of utility; businesses, and industries and all their money arguments - but, as I said - we must consider Earth as priceless.

I thank you for listening to the "ordinary" citizions, and please keep in mind we need someone to "represent" us.

Please place this letter in the official hearing Record.

Diana Grubbs
RR#1 Box 235
Muncie, In 47385



The Honorable Philip Sharp: 6-11-88

Dear Sir:

I know you will be here in Indianapolis but I can not attend on the 20th June. but I will be there in spirit.

I am 78 years old and I want something to be left of our country, for my childred - grandchildren + great grandchildren to be proud of. A clean country is not too much to ask.

I know you will do all you can to protect our forests and Rivers from acid rain before it is too late.

Thank you for carcing

Sincerely

Albert C. Bergman

PS. Please place this letter in the official hearing record.

**Mr Albert Bergman**
6140 E 9th St
Indianapolis IN 46219

Mrs. G. S. Tombaugh
313 Iroquois Dr.
Evansville, IN 47715

313 Iroquois Dr.
Evansville, In 47715
16, June 1988

House of Representatives
2452 Rayburn House Office Bldg.
Washington, D.C. 20515

Dear Rep. Shark,

Unable to attend the hearing in Indianapolis on the 20th, I feel pressed to address the issue to you in writing.

Together, we must do something NOW for our wonderful, beautiful country and our people about, CLEAN AIR!

You, being a key person in the Clean Air Act, need to know you have my support along with many other concerned citizens.

You may have missed the comic strip Doonesbury in Sunday, June 12th paper, so I'm enclosing it. Pictures speak louder than words.

It's devastating to realize the damage already done to our environment.

Know you have my support!

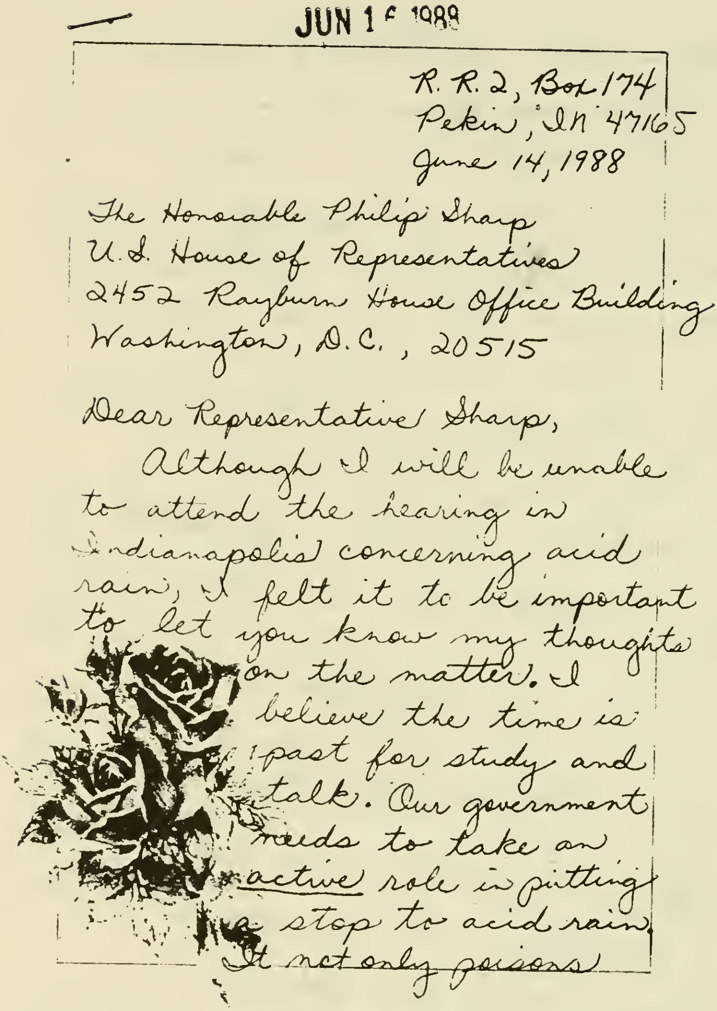
Please— do push this issue NOW

Sincerely Yours,

Laurabeall Tombaugh

P.S. If possible, place my letter in the Official hearing record.
Thanking you for your efforts in this battle

LPT.



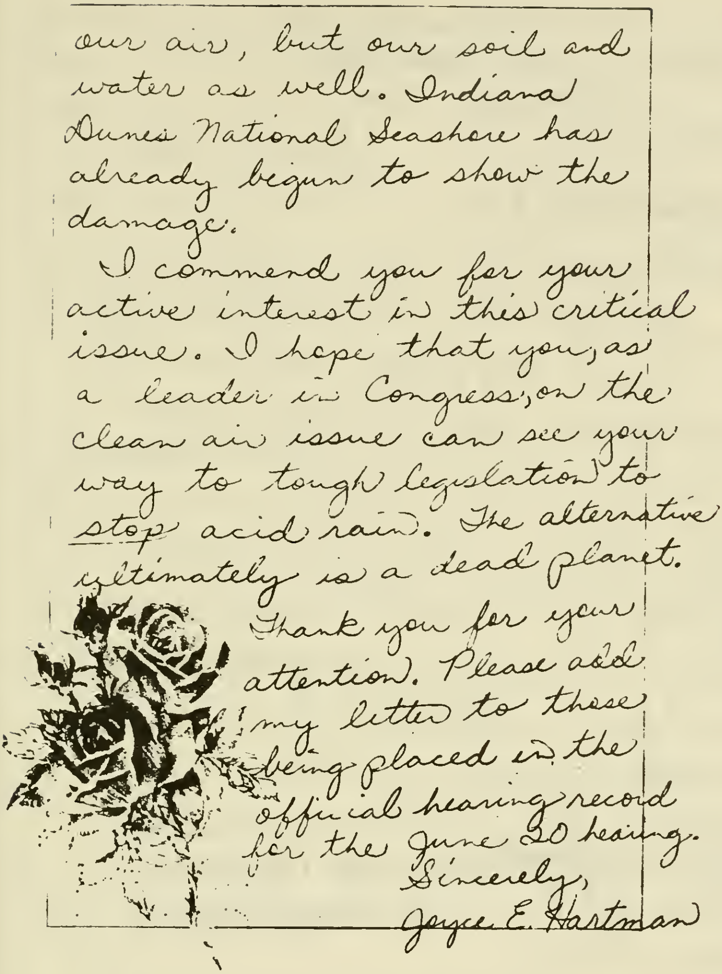
JUN 16 1988

R. R. 2, Box 174
Pekin, IN 47165
June 14, 1988

The Honorable Philip Sharp
U.S. House of Representatives
2452 Rayburn House Office Building
Washington, D.C., 20515

Dear Representative Sharp,

Although I will be unable to attend the hearing in Indianapolis concerning acid rain, I felt it to be important to let you know my thoughts on the matter. I believe the time is past for study and talk. Our government needs to take an _active_ role in putting a stop to acid rain. It not only poisons



our air, but our soil and water as well. Indiana Dunes National Seashore has already begun to show the damage.

I commend you for your active interest in this critical issue. I hope that you, as a leader in Congress, on the clean air issue can see your way to tough legislation to stop acid rain. The alternative ultimately is a dead planet.

Thank you for your attention. Please add my letter to those being placed in the official hearing record for the June 20 hearing.

Sincerely,
Joyce E. Hartman

Vicki and Kevin Finn
Route 5 Box ~~470~~ 469
Nashville, Indiana 47448

June 10, 1988

Dear Representative Sharp,

As chairman of the Energy + Power Subcommittee, you must be commended. First, I'd like to thank you for your introduction of the energy efficiency bills which deal with Federal buildings and fluorescent lights. Both are significant steps in the right direction. This nation must learn that energy conservation and efficiency is good, smart business.

Secondly, I recently learned of the hearing scheduled for June 20, 1988 in Indy on clean air. Even though I am not in your district, I'd like to make my feelings Known Unfortunately due to work commitments, I will be unable to attend. Please feel free to place my comments in the hearing record.

In brief, I am concerned about our air and personally feel that more must be done to clean it up. If we fail to act, our forests, crops, health etc. are at risk. We must act quickly and firmly to reduce emissions of sulfur oxides, nitrogen oxides, CFC's, ozone, and particulates. I urge you to favorably report strong clean air legislation from your subcommittee.

Thank you for the opportunity to voice my concerns. I look forward to hearing of your subcommittee's progress toward cleaning up our nation's air pollution problems. Since we all are at risk, we all must be involved in the clean up, both physically and financially.

Sincerely,

Cicki M. Finn

P.S. I apologize for the messiness of this letter. Hope you can decipher it!

Mary Sue Pollom
19066 Oakmont Park S. Dr.
South Bend, IN 46637

6-16-88

The Honorable Philip Sharp.
House of Representatives
Washington, DC.

JUN 20 1988

Dear Representative Sharp! –

I know you will be in Inaplis on June 20th + regret that I cannot be there to support the strong acid rain control proposal.

I am a Pharmacist + love the outdoors + Indiana's lakes + dunes. I know the terrible damage acid rain is causing around the world, as well as in Indiana + the US + strongly urge you to support the current legislation to help control it!

Thank you
Sincerely
Mary Sue Pollom

[illegible]

June 10, 1988

John F. Williams
RR #2, Box 295
North Vernon, IN 47265

Representative Phillip Sharp
U.S. House of Representatives
2452 Rayburn House Office Building
Washington, D.C. 20515

Representative Sharp:

This letter is in reference to your meeting at Indianapolis reference acid rain. I wanted to voice my opinion in support of your actions to clean up our air,water and soil.

I will not be able to make this meeting and thus this letter is written in my stead. Any legislation to promote elimination of acid rain has my support.

Sincerely,

John F. Williams

John F. Williams

527 N. Oakland Ave.
Mishawaka, IN 46544

The Honorable Philip Sharp
U. S. House of Representatives
2452 Rayburn House Office Building
Washington, D.C. 20515

Rep. Sharp:

I recently heard that you will be in Indianapolis on June 20 to conduct a hearing on what Indiana citizens think about acid rain. Unfortunately, I will be unable to attend this hearing. However, I would like you to place this letter in the official hearing record.

I care about cleaning up acid rain pollution! The time has come to stop studying the problem. We must begin to take urgent action. Whatever utility rate increases come about from controls on acid rain pollution, we must be prepared to sacrifice a certain amount to achieve a greater degree of safety from this type of pollution.

Costs are relative. Acid rain kills crops and reduces crop yields significantly. Certainly, the health costs through premature death and heart disease would offset much of the cost of pollution controls for utilities. And much more directly, the damage to lakes and streams (particularly in Indiana) and trees has an adverse economic impact on recreation dollars across the country.

As Chairman of the House Energy Subcommittee, you are in a position to do something about acid rain. I hope you will act wisely to solve one of our most pressing problems.

Sincerely,

Barry Wertz

Barry Wertz

JUN 16 1988

630 Maplewood Ave.
Anderson, IN 46012
June 14, 1988

The Honorable Philip Sharp,
U.S. House of Representatives,
2452 Rayburn House Office Bldg.,
Washington, D.C. 20515

Dear Mr. Sharp:

Since I will not be at your Indianapolis hearing on June 20 regarding clean air, I ask that this letter may be placed in the official hearing record.

With all the accumulated scientific and observable evidence that acid rain does indeed exist and that it is negatively affecting our environment, I can't understand why there has been so much controversy and delay in legislating effective controls.

I believe acid rain is damaging our forests, particularly evergreens; I believe acid rain is destroying fish in our lakes, and I believe acid rain is lowering crop yields, to say nothing of polluting our air.

We are already paying a price for acid rain. I'm willing to pay a price for the control of acid rain and that control needs to be given greater impetus NOW.

I appreciate your efforts in this direction.

Thank you.

Sincerely,

Walter Miller

66603 Pine Road
North Liberty, IN 46554
June 13, 1988

The Honorable Philip Sharp
U.S. House of Representatives
2452 Rayburn House Office Bldg.
Washington, D.C. 20515

JUN 16 1988

Dear Representative Sharp,

Since I won't be able to attend your hearing on the acid rain problem to be held in Indianapolis on June 20th, I decided to let you know how I feel about this problem through this letter.

For the last several years, I have noticed that the Sycamore trees here in northern Indiana just haven't been fully leafing-out in the Spring and Summer months as I remember them doing so in my youth. They are really having problems. A few of the branches will get fully-formed leaves while other branches will get a few leaves which are much smaller in size. I have heard recently that the Sugar Maple trees of the northeastern states are being seriously affected by acid rain deposition, and the quality and quantity of the maple syrup harvest is being affected as a result. Could it be that acid rain is also affecting our Sycamores here in Indiana?

As you should know by now, acid rain does kill trees, it results in fishless lakes, it impacts the size of the farmers grain harvests, and it damages buildings and art works especially those built with limestone.

It seems logical to me that contractors and architects should be searching for building materials which aren't affected by acid rain as much as limestone. And, since Indiana is world famous for its limestone industry and is the primary source of limestone for buildings, sooner or later acid rain and its effects are going to have a negative impact on the desirability of southern Indiana limestone as a building material. Thats something to think about.

Thank you for taking the time to read my letter. Please include it in the official hearing record for the June 20th hearing.

Sincerely,
John A. Bogucki
Biology teacher
La Salle High School
South Bend, Indiana

1522 Hebron Church Road
Henryville, IN 47126
June 13, 1988

The Honorable Phillip Sharp
U.S. House of Representatives
2452 Rayburn House Office Building
Washington, D.C. 20515

Dear Representative Sharp:

I regret I cannot be in Indianapolis on June 20th during your visit there, but I want you to know my veiws about acid rain. I request that my letter be placed in the official hearing record.

I live near the Clark State Forest in Henryville, Indiana and can see the damage acid rain is doing. I can see the forest deteriorate due to the pollution from acid rain. The trees are not as full and lush. They look scraggly and unhealthy and under stress.

I work near Louisville, Kentucky and the air is so filled with the pollution it appears you could cut it with a knife. The ozone level is in the unhealthy range more than half the summer!

I have two young children and I fear for their health. Already one son is exhibiting signs of allergies in part due to the air he has to breath.

I care about Acid Rain and Air Pollution in Indiana and do not mind having to pay higher taxes for Clean Air and a healthy environment. I feel if we do not spend money now to take care of the problem, we will be paying much more later in the form of higher medical bills, higher food bills due to poorer crop yeilds, and in lessening aesthetic beauty of our forests along with a decline in their commercial value.

PLEASE take action and tackle the Acid Rain problem and reauthorize a strong Clean Air Act as soon as possible. The time for more talk and study is gone. We need action taken now without further delay.

Thank you for your consideration of this.

Sincerely yours for Clean Air,

Deborah Hackman

June 13, 1988

The Honorable Philip Sharp

U.S. House of Representatives
2452 Rayburn House Office Building
Washington, D.C. 20515

Dear Hon. Sharp:

CLEAN AIR??????? Yes, YES, YES.

Let us first take into consideration the fact that clean air: pure air is the number 1 requirement of the human body, --- even more urgently, constantly and continuously required, physiologically, in your body, in my body, and in the bodies of the clean air opponents -- yes, more constantly required than water or food.

Clean air, so urgently needed every minute, throughout the human body, that a deficiency is life-threatening.

The physiologists understand.

The conservationists understand.

Can't the opponents be made to understand???

The Clean Air Act should be supported by every individual and by State and Federal Governments.

Power to you in the Indianapolis meeting, and in every effort made to meet our basic needs.

May you and your associates be the powerhouse you deserve to be.

100% success to you in every effort you put forth.

Sincerely,

Katherine M. Roehl

10189 Pretty Lake Trail
Plymouth
Indiana 46563

JUN

212 E. Navajo Drive
West Lafayette, IN 47906

June 14, 1988

The Honorable Philip Sharp
U.S. House of Representatives
2452 Rayburn Building
Washington D.C. 20515

Dear Representative Sharp:

We cannot be in Indianapolis June 20th to voice our concern about acid rain, but we wanted you to know that we feel it is urgent that Congress act now to stop this environmental onslaught. Acid rain is seriously damaging our trees, our crops and our rivers and lakes. Studies indicate that it is dangerous to our health.

No more studies, no more delay. Urgent action needs to be taken now to stop acid rain. Thank you for the time and effort, you personally,are putting into this project.

Sincerely,

Charlene Stone
Shelley C. Stone

Charlene Stone
Shelley Stone

SHARON ROSENBARGER
3200 ZOAR CHURCH RD.
CORYDON, IN 47112

June 13, 1988

JUN 1

Mr. Phillip Sharp
U. S. House of Representatives
2452 Rayburn House Office Bldg.
Washington D.C. 20515

Dear Mr. Sharp,

I am writing to you regarding the meeting concerning "Acid Rain" in Indianapolis, Indiana on June 20, 1988. Although I cannot personally attend this meeting I wanted to have my views known.

I am 23 years old and am becoming very concerned about the future of the world. Acid Rain used to be something that was everywhere but here. Well, that isn't so anymore. Every year we hear more and more about the subject and I think it's time we start doing something about it before its too late. Its time for the government to take a stand on acid rain and start controlling the pollution of factories and automobiles everywhere so we can get this problem under control. Acid rain has already taken a larger toll than most realize and it can only get worse if we don't do something about it now, not later.

Please try and get the word out that acid rain is something we can do something about but we must get started now. We only have one world and we have an obligation to take care of her and protect her not only for ourselves but for future generations to come.

Best regards,

Sharon Rosenbarger

Sharon Rosebarger

JUN 20 1988

June 15, 1988

Jennifer McMonigle
3600 Lotticks Lane
Corydon, Indiana 47112

The Honorable Philip Sharp
U.S. House of Representatives
2452 Rayburn House Office Building
Washington, D.C. 20515

Dear Representative Sharp:

I am aware that you will be holding a meeting in Indianapolis on June 20 to hear citizens thoughts on acid rain. I am unable to attend the meeting, however, I did wish to express my views on the subject, and request that this letter be entered into the official hearing record.

I have been concerned about acid rain, since I first heard the term more than eight years ago. Since that time, evidence has been mounting that acid rain is a real threat to our Earth. The Black Forest in Germany has been in decline for several years, due to acid rain. The Sugar Bush in Canada is in decline, due to acid rain. Thousands of North American lakes and streams have been acidified beyond the capability of supporting acquatic life, due to acid rain. Crop yeilds are down, resulting in losses of 1-2 billion dollars annually, due to acid rain. Yes, the evidence is mounting, but still, no action has been taken to control the problem.

Acid rain seems to be a problem people (including our government) think only affects people elsewhere, not in their own backyard. This is definitely not the case. My sister, while living in Floyd Knobs, Indiana (a semi-rural area across the river from the Louisville Metro Area) conducted her own impromptu test of the acidity of the rainfall. After a period of "Moderate" pollution (as judged by the Air Pollution Control Board of Jefferson Co., KY), she tested the rainfall using litmus paper. For the first 30 minutes of moderately heavy rainfall, the water had the acidity of vinegar!! And this test was conducted over three years ago. Acid rain is definitely a problem which must be considered to affect the Indiana area, as well as the rest of the country and the world.

Acid rain is only one of the problems which arise from the high level of air pollution which our country now faces. I work in Louisville, Kentucky and during the summer months it is appalling to drive to work and see the hazy brown skies in the morning. From the window of my 16th floor office, I have a nice view of Floyd Knobs on the Indiana side of the Ohio River on a clear day. During the summer, however, there are times when they are totally obstructed by the smog and haze. It is definitely not a pleasant sight. Just one day ago, on June 14, the Ozone Level as reported by the Jefferson County Air Pollution Control Board reached the highest level in five years!!

I believe that strict controls are needed and should be implemented in order to reduce drastically the air pollution which is slowly killing the people, plants and animals of our country and the world. If it means that the general public must bear part of the cost (increases in utility bills, higher automobile costs, or a raise in taxes dedicated to clean up and prevention of pollution), I am willing to pay my share! However, I believe the big polluters (industry) should also pay their fair share. After all, besides automobiles, they are the main cause of our low quality of air in this country. I think it is imperative that industry be required to install scrubbers, air pollution control devices, etc. in their plants NOW, before the problem grows to larger proportions. As for the problem of pollution generated by automobiles, maybe it is time that we begin to push harder to remove older, more polluting vehicles from the road, and require that deisel powered vehicles also have more stringent exhaust standards. Possibly more money should be spent on public transportation systems in order to reduce the need for every man, woman, and teenager to have a car to transport themselves to their destinations. I realize that it will take money, lots of money to solve this problem. But is it really cost-effective to ignore the problem because it will "cost too much" to remedy, and instead poison our atmosphere past the "point of no return"? Is saving human lives too costly? Is preserving our wildlife, plantlife, and countryside from irreversable damage less important than the corporate profit margin? I don't believe so.

We only have one world on which to live. We can choose to care for and nurture the environment and all it contains, or we can choose to leave the problems unsolved and ignored. I firmly believe that the pollution and degradation of our world is an issue that MUST BE ADDRESSED NOW, before it's too late. This is not a problem that we can afford to put off until "later", when it may be more convenient. It may be too late, then. Our children and future generations deserve a safe and ecologically sound world to live in. They do not deserve to inherit the problems of a generation who would not face up to the problems that pollution and ecological rape.

As the Chairman of the House Energy Subcommittee, I urge you to please put the interest of the common man, of the Earth we live on, and of future generations and your children above that of the Profit Motive in order to stop the problem of environmental and air pollution before we reach that "point of no return".

This is a problem that we cannot afford to leave for our children to resolve.

Thank you for your time, and I hope that you will demonstrate that you really do serve the people of Indiana and the nation by coming up with a fair and effective means to solve the problems of acid rain, air pollution, and environmental degradation.

Sincerely,

Jennifer M McMonigle

Jennifer A. McMonigle
Citizen of Indiana

JUN 14 1988

June 11, 1988

Dear Representative Sharp:

I understand you are holding a hearing in Indianapolis, Indiana on June 20 concerning the subject of acid rain. I am sorry I will be unable to sttend this hearing.

I did wish to let you know that I believe acid rain is a national concern and certainly not a local issue alone. It may be a man-made problem but not an easy problem to be controlled by man.

My husband and I built in a beautiful area of wild growth which included pines, oaks, redbud, and many other types of trees and bushes. These plants were in the best of health at that time which was about eleven years ago. In the past three to five years we have been fighting the loss of many white pines. They may die over a period of a year or in a matter of a few weeks. We had them tested for insect and disease infestation, root damage, etc. No evidence was found as to a normal cause for their weakening and death. All that we learned was that the trees were under a great amount of stress.

I just read a statement which read,"The park's (Indiana) fragile ecosystem--particularly Jack and White pines--has suffered visible damage." (NWF ACTION ALERT, June 7, 1988.) I have wondered in the past if acid rain could be at "the root" of our pine decline, now I am more worried that acid rain pollution may be the cause.

I feel powerless to stop such future disaster to our environment and ourselves. I can only hope, by adding my voice to others who are concerned, that some action by our government will stop this form of pollution. Please do your best to bring about successful legislation for clean air. I would like for my letter to be placed in the official hearing record. Thank you.

Sincerely,

Suzanne Huntsman

Mrs. Suzanne Huntsman

R.R. 2, Box 108D
Hagerstown, Ind.
47346

June 15, 1988
Rt 1 Box 14
Marengo IN
47140

JUN 20 1988

Honorable Philip Sharp,

Since I am unable to attend your upcoming speaking engagement in Indianapolis, I would like to write in support of enlarging the Clean Air Act and to obtain its renewal and hopefully strengthening. Acid Rain is becoming a severe problem and we know what the causes and solutions are.

Unfortunately, too many people are apathetic about the problem, or their profit motive is blinding them from admiting the facts. We must act now before more of our squandered inheritance is destroyed on the earth.

Please put my letter down in the official record as in favor of the Clean Air Act.

Sincerely Amy B. Nicholson

6/14/88

JUN 20 1988

Dear Congressman Sharp,

As Chairman of the House Energy Subcommittee,you are holding a hearing in Indianapolis to find out how much the citizens of Indiana care about acid rain.Unfortunately I am unable to attend your hearing to strongly voice my opinion,so I thought I would write you a letter in hopes that you would use it in the official hearing record.

As you know,acid rain kills.It kills crops,it kills fish,it kills plants,and most importantly it kills people.It destroys our land,it pollutes our air,it kills our plants,and it harms our food chain.So what are you going to do about it?

As a citizen of Indiana,I say ACID RAIN SUCKS.I am not proud of it,and as a citizen of Indiana,I don't want it.Of course no one wants it.And if no one wants it's your job to see no one gets it.We-as a nation-refuse to act.I'm not going to sit around and let this thing kill me.I want to do something about it.Unfortunately,all I can do is write to people,and tell them my opinion,and hope that they do something about it.I hope to God,you can do something about it.You are one of the key players in all of Congress on clean air.Show America what you can do - make a difference.

Together,we the citizens of Indiana ,can see to it that you return to Washington aware of the strong concern that I,and the citizens of Indiana share about acid rain.The time for study and talk is gone.Action is what is needed to be taken.Thankyou for your time,I hope I used it well.And I hope that you recieve this letter before the 20th.Thanks again.

A CITIZEN THAT CARES.

Eric Wells
7133Baring pkwy.
Hammon,INDIANA 46324
d,

June 16, 1988

The Honorable Philip Sharp
U.S. House of Representatives
2452 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Sharp,

I will not be able to travel to Indianapolis to voice my opinion regarding our urgent need for clean air. The acid rain problem are killing crops, it endangers our health with possibility of respiratory and heart disease, it damages our Indiana lakes and streams, kills fish, kills trees etc. I feel very strongly that something must be done to clean up the air we breathe and depend on.

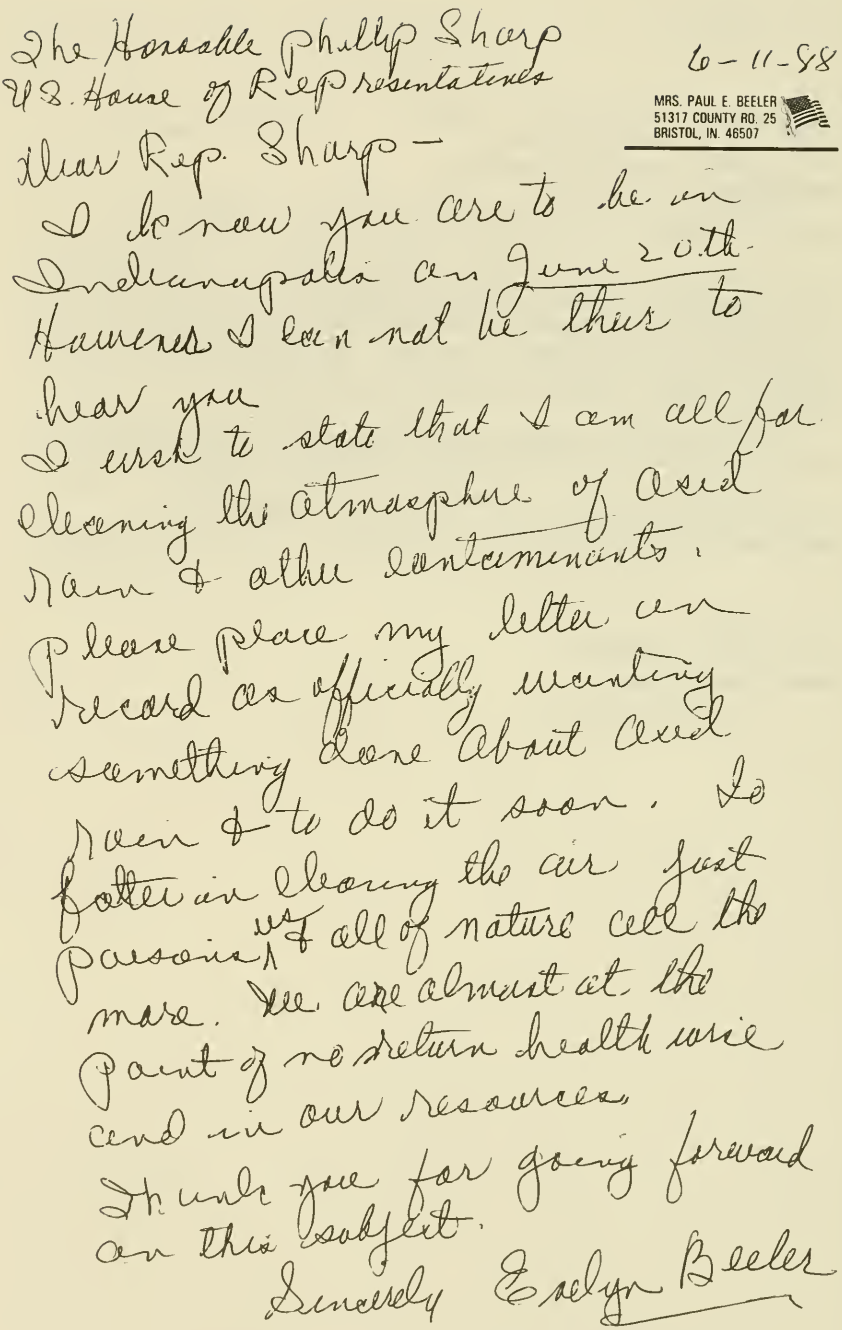
I am requesting that my letter be place in the official hearing record as a substitute for being unable to speak in person.

Thank you for any help you can give on this matter.

Sincerely,

Beverly J Robinson

Mrs. Beverly J. Robinson
54428 Terrace Lane
South Bend, IN 46635



The Honorable Phillip Sharp
U.S. House of Representatives

6-11-88

MRS. PAUL E. BEELER
51317 COUNTY RD. 25
BRISTOL, IN. 46507

Dear Rep. Sharp—

I know you are to be in Indianapolis on June 20th. However I can not be there to hear you

I wish to state that I am all for cleaning the atmosphere of Acid rain & other contaminants.

Please place my letter on record as officially wanting something done about Acid rain & to do it soon. To falter in cleaning the air just poisons us & all of nature all the more. We are almost at the point of no return health wise and in our resources.

Thank you for going forward on this subject.

Sincerely Evelyn Beeler

JUN 14 1988

RR 1
Commiskey, IN 47227

June 10, 1988

The Honorable Philip Sharp
U.S. House of Representatives
2452 Rayburn House Office Building
Washington, D.C. 20515

Dear Congressman Sharp,

I will not be able to make the June 20, 1988 hearing re acid rain in Indianapolis. In spite of that I wanted to write to tell you that I support any and all efforts to clean up our air and stop the increasing incidence of acid rain.

I know that you are aware of all the environmental and health consequences of our country's exposure to this growing menace and trust that you will do all in your power to help solve this problem.

I ask that this letter be included as part of the official hearing record.

Thank you.

Respectfully,

Ed Guljas

Ed Guljas
RR 1
Commiskey, IN 47227

June 15, 1988

Representative Phil Sharp
U.S. House of Represenatives
2452 Rayburn House Office Building
Washington, D.C. 20515

RE: the Clean Air/Acid Rain meeting to be held in Indianapolis on June 20th

Dear Representative Sharp,

Thank you very much for caring enough about the air we breathe to hold a citizens hearing in our area.

I will not be able to attend the June 20th meeting, but would like to let you and your committee know that I am truly worried about the effects of acid rain has on our forests, crops, lakes and in turn our ground water. The longer we refuse to act the worse the problem become.

Will you please place this letter in the official hearing record of the meeting as another concerned citizen?

Thank you again for your concern and awareness of the citizens feelings about cleaning up acie rain pollutions and getting legislation to control this very important and damaging problem.

Sincerely,

Maxine Trowbridge

Maxine Trowbridge
R#1 Box 240
Etna Green, IN 46524

**MEMO FROM...**

Urma English
28 So. Roby Drive
Anderson, IN 46012

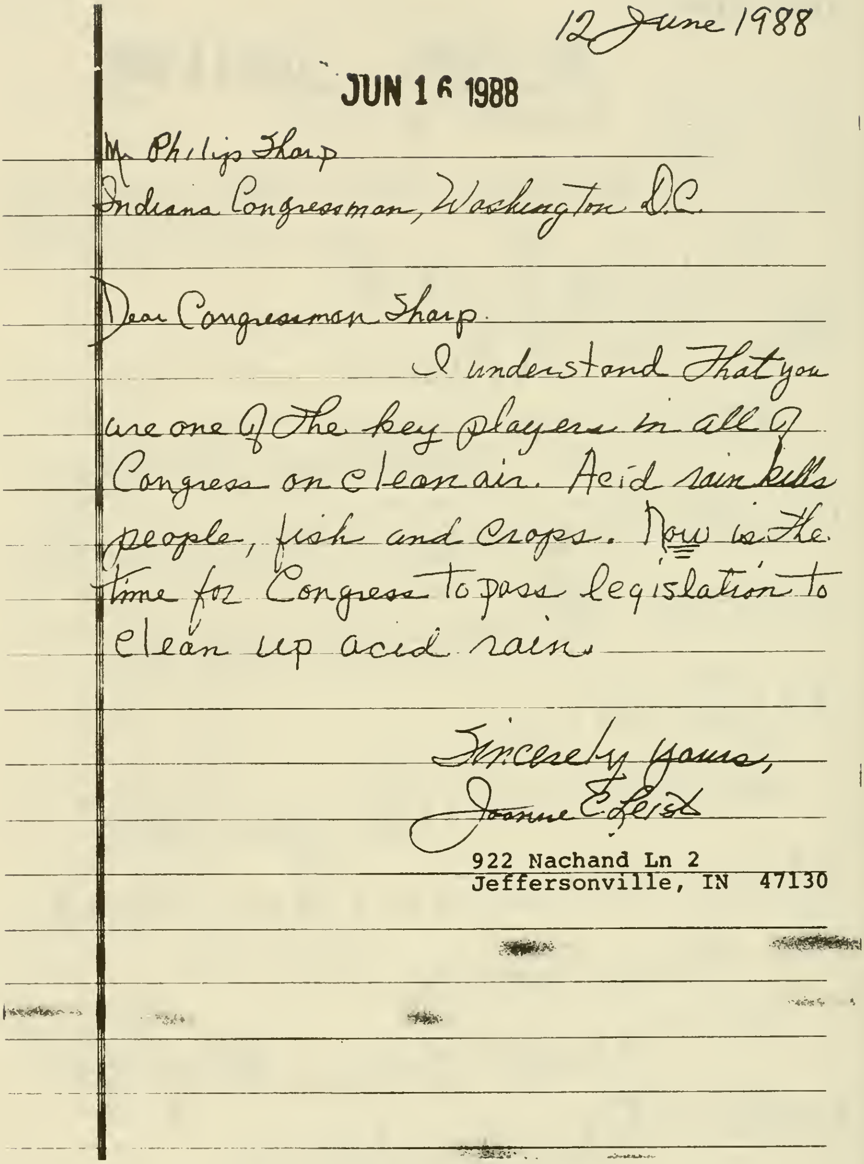
JUN 15 1988

To: Representative
Philip Sharp
Re: Acid Rain

Please add me to your list of people concerned about the problems of acid rain.

I commend you for your continued interest in this area.

We must come to grips with this problem.



12 June 1988

JUN 16 1988

Mr Philip Sharp
Indiana Congressman, Washington D.C.

Dear Congressman Sharp.

I understand That you are one of The key players in all of Congress on clean air. Acid rain kills people, fish and crops. Now is The time for Congress to pass legislation to clean up acid rain.

Sincerely yours,
Joanne E Leist
922 Nachand Ln 2
Jeffersonville, IN 47130

J.M.J.

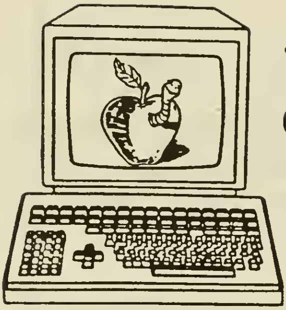
6-18-88

JUN 21 1988

Mr Shark

I would like to attend the meeting in Indianapolis to express my thoughts conserning ~~about~~ acid rain. I am sorry that I can not attend the hearing. Please do every thing you can to reduce the harmful acid rains.

Sincerely yours
Bernard J. Becker
1399 Eskew Road
Boonville Ind.



JUN 17 1988

June 13, 1988

Janie Neufelder

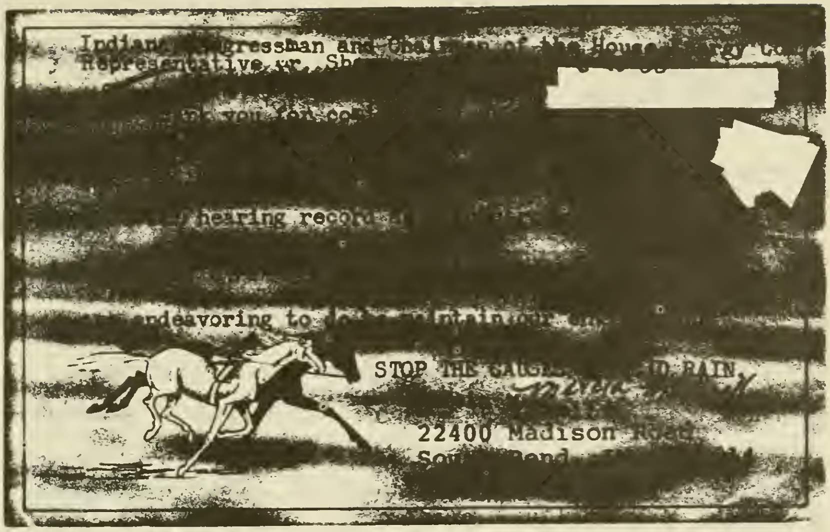
Dear Rep. Sharp,

We can not be with you at the Acid Rain Hearing on June 20 but we would like for you to know how we feel. We are very aware of the acid rain problem & hope that you will do everything in your power to help clean & protect our environment.

Thank you very much.

Sincerely,

Janie & Dan Neufelder
1402 Chestnut
Columbus, IN 47201



Indiana [illegible]gressman and [illegible] of the House [illegible]
Representative Mr. Sh[illegible]

[illegible] you for co[illegible]

[illegible] hearing record [illegible]

[illegible]ndeavoring to [illegible] maintain our [illegible]

STOP THE SAUG[illegible]D RAIN

22400 Madison [illegible]
Sou[illegible] Bend [illegible]

JUN 17 1988

Dear Mr Sharp,

I am aware that you are holding a hearing Monday, June 20 concerning the Clean Air Act. Because of my work, I will not be able to be present at this.

I would, however, like to express my concern that steps need to be taken to insure we have clean air. So many other factors (money, "progress", growth.) overshadow the fact that all the success in the world means nothing if you can't breath your air. I realize that insuring clean air may mean sacrificing some comforts and paying higher utilities but it will be worth it for me and my children & their children. People can make this issue as complicated as they want, but nothing has to be complicated, and as the saying goes "Better safe than sorry!".

Sincerely,

Steve Gregory

1148 Tincher Road
Mooresville, IN 46158

I would like this placed in the official hearing record.

JUN 20 1988

6/18/88
800 Maple Ave.
Gary, In. 46403.

The Honorable Philip Sharp,
U.S. House of Representatives,
2452 Rayburn House Office Bld,
Washington, D.C. 20515.

Dear Honorable Philip Sharp.

I am writing to you about my concern over Acid Rain. I understand that you are one of the Key players in All of Congress on clean Air. And how you decide to tackle the acid rain problem will directly affect the fate of the Clean Air Act.

I know, most everyone knows and you know that Acid rain is a killer! And the only way to stop this monster is to take Urgent action Now without further delay.

Acid Rain is not predjudice it kills everything in the long run.

Acid Rain is not Cheap it's Cost mount's higher each day we -- as a nation -- refuse to Act.

Please place my letter in the Official hearing Record.

I pray that your voice will victorious in determining the reauthorization of the Clean Air Act.

God Bless You
Ms Diana L. Whigham

JUN 20 1988

June 16, 1988

William L. Kelly
P.O. Box 528
Portland, Indiana 47371

The Honorable Phil Sharp
House of Representatives
2452 Rayburn House Office Bldg.
Washington, D.C. 20515

Dear Representative Sharp:

I regretfully am unable to attend the clean air conference in Indianpolis June 20, due to prior commitments.

I feel that it is time that we stand responsible for our actions and begin the long process of cleaning up our environment. We can no longer continue to pollute the atmosphere and our water resources as we neglectfully have in the past!

Acid rain is only a small part of the problem, but has a large overall effect. Since the industrial concerns are major contributors to this pollution, I strongly support legislation which will limit their pollution.

Thank you.

Yours truly,

William L. Kelly

William L. Kelly

June 20, 1988

Representative Phil Sharp
U.S. House of Representatives
Washington, D.C. 20515

Dear Representative Sharp:

Because of our schedules, we were unable to attend the June 20th meeting in Indianapolis regarding the important *Acid Rain* topic. This should in no way reflect our lack of concern over this issue. We feel emissions and other acid rain antecedents need more extensive curtailment in the midwest region, including Indiana.

Your record shows that you are indeed aware of the consequences of acid rain, so we will not review them here. But we encourage you to continue your course in getting the strong acid rain proposal through the House. We feel that our health as well as our natural resource heritage is at stake. Preserving these vital assets must take precedence over higher utility bills or any industry objections.

Thank you for considering our view.

Sincerely,

Dr. Philip R. Berck, Ph.D.

Ruthann Berck OD
Mrs. Ruthann R. Berck, O.D.

RR 3, Box 393
Morgantown Indiana

JUN 22 1988

R.R. 4, Box 156
Alexandria, IN 46001
June 20, 1988

Representative Philip Sharp
U.S. House of Representatives
2452 Rayburn House Office Building
Washington, D.C. 20515

Representative Sharp:

I know you are in Indianapolis today - I wish I could be at today's hearing regarding acid rain.

I want to support those that at today's hearing are lending their support toward conservation. Crop and forest damage and health problems are caused by sulphur and nitrogen oxide pollution. The evidence is overwhelming that acid rain harms the world around us in ways that translate into very real costs for all of us. Acid rain kills fish, stunts crop growth, and leaves dead and dying trees. And the costs mount higher each day we, as a nation - refuse to act.

The time for more study has come and gone. Urgent action needs to be taken now, without further delay.

Thank You.

Sincerely,
Joyce K. Allen, R.N., Ed.D.

JUN 17 1988

JUNE 13, 1988
3842 W. SUBURBAN CT.
COLUMBUS, IN 47201

THE HONORABLE PHILIP SHARP
U.S. HOUSE OF REPRESENTATIVES
2452 RAYBURN HOUSE OFFICE BLDG.
WASHINGTON, D.C. 20515

DEAR SIR:

UNFORTUNATELY, I AM UNABLE TO ATTEND THE JUNE 20TH ACID RAIN HEARING WHICH YOU HAVE SCHEDULED IN INDIANAPOLIS. I AM EXTREMELY CONCERNED ABOUT THIS ISSUE BUT I AM PLEASED TO SEE THAT YOU ARE TAKING THE OPPORTUNITY TO FIND OUT PUBLIC OPINION ON THIS SITUATION.

I AM CERTAIN THERE WILL BE A LARGE NUMBER OF OPPONENTS TO A CLEAN AIR BILL, PRIMARILY BUSINESS AND INDUSTRY REPRESENTATIVES WHO FEAR THE ECONOMIC IMPACT OF HAVING TO CLEAN UP THE AIR. I REALIZE THAT MEASURES TO CURB ACID RAIN POLLUTION WILL INEVITABLY CAUSE PUBLIC UTILITY RATE INCREASES BUT I AM MORE CONCERNED ABOUT THE DESTRUCTIVE AND COSTLY IMPACT WHICH ACID RAIN POLLUTION HAS ON OUR ENVIRONMENT. IN ADDITION TO CROP DAMAGE AND DESTRUCTION OF OUR FOREST, LAKE, AND STREAM HABITATS, ACID RAIN REPRESENTS A SERIOUS THREAT TO HUMAN HEALTH.

INSTEAD OF MAINTAINING REASONABLE UTILITY RATES BY ALLOWING THIS TYPE OF POLLUTION TO PERSIST WITH LITTLE CURTAILMENT, I WOULD PREFER TO SEE THAT EVERY EFFORT WAS MADE TO PRESERVE AIR QUALITY. THANK YOU FOR YOUR TIME. SINCE I WILL NOT BE AT THE HEARING ON JUNE 20TH, COULD THIS LETTER PLEASE BE INCLUDED IN THE OFFICIAL HEARING RECORD SO THAT MY OPINION WILL BE CONSIDERED AS A STRONG PLEA FOR MEASURES TO CONTROL ACID RAIN POLLUTION.

SINCERELY,
Cynthia H. Simes

JUN 22 1988

Susan Snyder
Route 3 Box 165
New Castle, IN 47362

June 19, 1988

The Honorable Philip Sharp
U.S. House of Representatives
2452 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Sharp:

Since I will be unable to attend your hearing in Indianapolis tomorrow, I wanted to write and encourage you to take a strong stand on our acid rain problem. As you should already know, acid rain kills crops by poisoning and starving the roots, resulting in a loss of one to two billion dollars per year. It also is damaging lakes, streams, and forest systems here in Indiana and in many other parts of the United States and Canada.

As Chairman of the House Energy Subcommittee, I am sure that you are tired of talking about this problem and realize it is now time to do something about it. Urgent action is needed now! So with your help we can get a tough acid rain program started and get the Clean Air Act reauthorizated soon.

Thank you for taking a stand for a clean, healthy environment and I hope that you will continue to support good environmental legislation in the future.

Sincerely,

Susan Snyder

Susan Snyder

JUN 16 1988

R. R. 1, Box 161A
Milroy, Indiana 46156
June 13, 1988

The Honorable Philip Sharp
U. S. House of Representatives
2452 Rayburn House Office Building'
Washington, D.C. 20515

Dear Representative Sharp:

I understand that you will be in Indianapolis Monday, June 20, 1988, to conduct a meeting with citizens of Indiana to get their opinions on the acid rain problem. As you know from meetings in Rushville, Indiana, this is a special concern of mine.

In additiion to the tremendous damage being done to our beautiful national buildings and monuments of limestone, the following problems become more and more evident:

1. Damage to lakes and streams is becoming evident. Where once we had about a dozen varieties of edible fish in our creek, we now have only carp.

2. Damage to crop land - either requiring excessive investment in lime or resulting in soil which will not grow many Kinds of crops.

3. Increasing sulfate and nitrate air pollution.

4. And, one of the saddest of all effects, the damaging and killing of the large, beautiful and productive forests of the midwest, northeast and southern Canada. Many pines and ash are dying. The nursery botanists can find no insects or any other known damage. It is theorized that much of the damage to these trees, and their gradual decline, is due to air pollution and acid rain.

Please urge your committee to act soon, before our forests are gone. If it were at all possible, I would attend the meeting. However, I cannot and I do want you to receive my opinion.

Sincerely,

Carolyn H. Cleland

Carolyn H. Cleland (Mrs. Arthur)

# ACID RAIN OVERSIGHT

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WEDNESDAY, JUNE 22, 1988

House of Representatives,
Committee on Energy and Commerce,
Subcommittee on Energy and Power,
*Washington, DC.*

The subcommittee met, pursuant to notice, at 1:45 p.m., in room 2322, Rayburn House Office Building, Hon. Philip R. Sharp (chairman) presiding.

Mr. Sharp. The subcommittee will please come to order.

This is the fourth of a series of oversight hearings our subcommittee has been holding on acid rain. Just this past Monday, we held a field hearing in Indianapolis. There, we learned of the enormous costs that many acid rain proposals would have on our country's heartland. We also learned that there are many in Indiana who are willing to talk about the acid rain problem and to explore whether and how it might be solved without doing irreparable harm to the Midwest.

At our initial hearing, we heard from the scientific community. We learned that there is a scientific consensus that acid rain is a problem caused by sulfur and nitrogen pollution. However, there is no consensus about how much emissions should be reduced and by when. The specifics of an acid rain control program cannot be determined apparently at this point by science. Those specifics are the responsibilities of legislators and must balance environmental risks against socio-economic costs.

Last week, the subcommittee explored the role of electricity conservation as a compliance strategy for acid rain controls. We learned that conservation could save utilities and their ratepayers billions of dollars in control costs. Conservation is also an incredibly important weapon against global warming. We certainly do not want to do anything that would discourage conservation. However, we also learned that it is difficult to craft, implement, and enforce conservation as a compliance strategy.

Our subject today is clean coal and acid rain. Many will say that this is a misnomer, that the hearing instead should be called clean coal or acid rain. It is interesting to me that both sides in the acid rain debate seem to imply that it is an either/or choice. Many industry advocates have presented the Clean Coal Program as an alternative to acid rain controls. In contrast, many advocates of acid rain controls have opposed the development of clean coal technologies, fearing that the Clean Coal Program could merely be a strategy to avoid acid rain legislation.

I firmly believe that this Nation must move forward to develop and demonstrate new clean coal technologies for environmental, energy security, and economic reasons. I also believe it is likely that Congress will, at some point, deal with acid rain. Thus, if acid rain controls necessarily preclude the development of clean coal technologies, I am afraid that bodes ill for the further development of the Nation's primary fuel for electricity. If there is some way for these two programs to complement one another, everyone will benefit. This is what I hope we can learn more about today.

Let me recognize our senior colleague from the full committee, the gentleman from New York, Mr. Lent.

Mr. LENT. Thank you, Mr. Chairman. It is a pleasure to be here at this final day of hearings on this subcommittee's investigation into the acid rain problem.

Today's hearing, like the three preceding it, will focus on an issue key to the resolution of the acid rain problem, the issue of clean coal technology. In particular, we will be trying to answer two important questions today. When will the technology be commercially available? And, what advantages will it have over conventional control technologies in reducing emissions?

The past 3 days of hearings on acid rain have demonstrated some important points. First, that while there is still a lack of consensus on the magnitude of the acid rain problem and its urgency, many in the scientific community appear willing to state that there is a problem. Second, if we are going to pass legislation reducing acid rain emissions, we should do so in a way that recognizes a role for conservation. Ignoring the important role conservation can play will unnecessarily increase costs at the expense of consumers.

In today's hearing, we have come to a third important issue, that of specific controls, for we know that conservation alone cannot solve this problem. On this particular issue, there are two divergent and ardently held positions. The first says that clean coal technologies will solve the acid rain problem by itself if we are willing to be patient, and the second says that clean coal technologies are only an excuse raised by opponents of acid rain controls to further delay action.

Like so many issues we have addressed in the past, the truth probably lies between these two extremes. Today, we will try to take a fresh and unbiased look at clean coal technology and what it can offer in helping us to solve this difficult problem.

Thank you, Mr. Chairman.

Mr. SHARP. Thank you.

The gentleman from Ohio, Mr. Oxley.

Mr. OXLEY. Thank you, Mr. Chairman. I appreciate the Chair's third hearing on this very important issue, particularly to our area of the country.

The efforts by many people here in Washington and, even more importantly, in the States, relating to clean coal technology do not go unrecognized. Those of us from Ohio are proud of the job that we have done. The people of Ohio, as you know, Mr. Chairman, passed a massive bond issue to fund clean coal technology, and we have been the recipient of quite a bit of Federal matching money to continue that process, and, indeed, the initial returns are very, very encouraging.

We are hopeful that the Congress will not be stampeded into a bill that would, indeed, close the door on this emerging technology just at the time that it is starting to bear some fruit and to show some promise for the future in the use of coal from our region of the country.

Indeed, it is difficult not to be impatient, but, at the same time, if you look at the NAPAP's report and some other studies that have been done, I think one has to be encouraged not only by the fact that the acid rain problem has at least been moderated if not abated. At the same time, we have seen continuing efforts by a lot of people who are a lot smarter than we are in providing avenues whereby we can, in fact, burn Midwestern coal cleanly, which obviously benefits not only our region but the rest of the country as well, and including our friends from Canada.

Most folks in my area are saying this: Let the emerging technology for clean coal do its thing, give us a chance to show our stuff. Then I think that we can look back on this in a few years and say we were the ones who really provided the opportunity for this emerging technology, one of the breakthroughs of this century which really does help everyone. I thank the Chair for his indulgence and yield back the balance of my time.

Mr. SHARP. I thank the gentleman.

Our senior Republican colleague on the committee, Mr. Moorhead from California, has a statement. He is normally faithfully here and has other business, and we will put that in the record. He may be joining us later.

Another of our colleagues from another committee who is very concerned about this will be arriving shortly. I think what we will do is take our first witness, and then we will have a statement from another gentleman from Ohio.

We have tried to structure this with one panel so we can have a good interchange of views as to what is happening and what can happen in terms of clean coal technology, and we welcome Mr. John Sprague with the U.S. General Accounting Office; Mr. Jack Siegel, the Deputy Assistant Secretary for Coal Technology at the Department of Energy; Mr. Kurt Yeager, vice president of the Coal Combustion Systems Division with the Electric Power Research Institute; Mr. R.E. Disbrow, president and chief operating officer of the American Electric Power Company; Mr. Paul Feira, president of the Industrial Gas Cleaning Institute; and Mr. Seth Schwartz, with Energy Ventures Analysis, Incorporated.

Gentlemen, I think you are probably familiar with our processes here. Several of you have testified before. We will be happy to make any written materials you have a part of what will become the printed record and be circulated among the members of the committee and otherwise to the public, but at this point we would like to have an oral summary from you of the key points that you wish to communicate, and then when you folks have finished we will have questions from our panel.

Mr. Sprague, we will be delighted to hear from you at this point.

## STATEMENTS OF JOHN W. SPRAGUE, ASSOCIATE DIRECTOR, GENERAL ACCOUNTING OFFICE; JACK S. SIEGEL, DEPUTY ASSISTANT SECRETARY FOR COAL TECHNOLOGY, DEPARTMENT OF ENERGY; KURT E. YEAGER, VICE PRESIDENT, ELECTRIC POWER RESEARCH INSTITUTE; R.E. DISBROW, PRESIDENT, AMERICAN ELECTRIC POWER, ON BEHALF OF CLEAN COAL TECHNOLOGY COALITION; SETH SCHWARTZ, ENERGY VENTURES ANALYSIS, INC.; AND PAUL J. FEIRA, PRESIDENT, INDUSTRIAL GAS CLEANING INSTITUTE

Mr. Sprague. Thank you, Mr. Chairman.

GAO is here today to discuss DOE's clean coal technology program, especially how the program relates to pending acid rain control legislation. Our work, which is being done at your request, is still ongoing, and therefore our views are preliminary on some of these matters.

By way of a little background about the program, in 1986 DOE selected nine projects for the first phase, or round one, of the program. Eventually, sponsors of two of the projects withdrew their proposals, and DOE selected four alternate projects to replace the two withdrawn projects. Currently, DOE is in the process of negotiating agreements with these four project sponsors.

DOE had some problems during the first phase in signing cooperative agreements with five sponsors by its April 1987 target date. Difficulties arose in finalizing financial and other business arrangements. In addition, DOE had trouble reaching agreements with sponsors to recover Federal costs and to obtain proprietary information, such as design and operational data.

Even though useful changes were made for round two negotiations, it appears that DOE will continue to have problems on recovering costs and obtaining technical data rights.

In January 1986, the special U.S. and Canadian envoys issued a joint report. The report recommended, among other things, that a commercial demonstration program give special consideration to retrofit technologies that could be applied to existing facilities using high-sulfur coal. The envoys' intent was to achieve some near-term emission reductions to abate acid rain.

For round two of the Clean Coal Program, DOE plans to shift the focus of the program more to emissions reductions to be consistent with the envoys' report, although there are definitional differences regarding retrofitability between DOE and EPA.

The estimated commercial availability dates of clean coal technologies range from 1992 to 2000, with most of the projects potentially available in the mid-1990's.

The Congress is considering many acid rain bills with varying compliance dates and emission reduction levels. Acid rain control legislation could have an impact on the commercialization and market penetration of clean coal technologies if emission reduction levels and schedules are not considered along with the commercial availability and capabilities of clean coal technologies.

If the Congress wishes to enhance the use of clean coal technologies, it may be advantageous to link their commercial availability with acid rain legislation consideration. This could be done by establishing compliance deadlines and emission reduction levels that allow for some near-term reductions in emissions that are not so stringent as to deter the longer-term use of clean coal technologies aimed at the same goal.

One such strategy included in some of the bills pending before the Congress which could accommodate both sets of objectives is a phase-in approach whereby States or utilities would reduce their emissions in stages. This strategy could result in early reductions in emissions as well as deferring costly decisions about the use of clean coal technologies until the success of this technology is more certain. Another strategy would be to extend compliance dates for utilities choosing to use clean coal technologies.

Although DOE is conducting the clean coal technology program under two broad 1974 acts, Senate and House Appropriations Committees have provided some direction for the program through various appropriations actions. DOE has also stated some broad program objectives which allow it to use wide discretion in implementing the program. If the Congress intends for the program to be part of an acid rain control program, they may want to include this provision when enacting the legislation.

In summary, DOE has taken action to solve some problems experienced in round one in the clean coal technology program, but others still remain. The major issue, however, is whether emerging clean coal technologies will be commercially available to achieve acid rain emission reductions within the time frames established and at reduction targets established in any bill the Congress may enact.

While we are not expressing an opinion on any of the bills before the Congress, the Congress should consider the potential role emerging technologies can play in reducing emissions to control acid rain.

Thank you, Mr. Chairman.

[Testimony resumes on p. 459.]

[The prepared statement and attachments of Mr. Sprague follow:]

## STATEMENT OF JOHN W. SPRAGUE

Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to present our views on the Department of Energy's (DOE) Clean Coal Technology (CCT) program and issues affecting the program. At the Chairman's request, we reviewed (1) the implementation and status of the program, (2) the relationship between the program and recommendations of the U.S.-Canadian envoys' report on acid rain, and (3) the potential effect that pending acid rain control legislation could have on the program. Our work is still ongoing and, therefore, the views we express today are preliminary and subject to change.

In summary,

-- DOE has funded seven projects for the first phase, or round one, of the program and is negotiating with sponsors to fund four other projects. The seven projects will receive $227.5 million in federal assistance and $529.8 million from nonfederal sources. DOE had problems in finalizing cooperative agreements for five of the projects because the sponsors had difficulties in completing financial and other business arrangements. Sponsors also objected to federal cost recovery provisions and providing technical design and operational data, which caused negotiation problems. While some useful changes were made for the second round of the program, DOE may have similar problems in negotiating future agreements.

-- In accordance with the U.S.-Canadian envoys' report on controlling acid rain, DOE plans to place more emphasis on funding emission reduction technologies in round two. However, DOE and the Environmental Protection Agency (EPA) disagree on the types of technologies that will result in near-term emission reductions on existing coal-burning facilities, as called for in the envoys' report. DOE and EPA need to resolve their differences on this matter.

-- The Congress is considering many bills to reduce emissions by varying amounts and time frames. While we are not expressing an opinion on any specific bill, the Congress should decide what the CCT program's role is in reducing emissions to control acid rain.

Before I discuss these areas further, let me provide some background on the program.

### THE CLEAN COAL TECHNOLOGY PROGRAM

The CCT program is a cost-shared demonstration program designed to encourage the commercialization of emerging clean coal technologies by providing federal financial assistance of up to 50 percent of the project costs. In 1985 the Congress made available $400 million from the Clean Coal Technology Reserve for round one of the program. In February 1986, DOE solicited cost-shared proposals for the construction and operation of projects that would demonstrate the feasibility and commercial application of a broad slate of emerging clean coal technologies. After evaluating 51 proposals, DOE selected 9 projects in July 1986 to receive a total of about $362 million in CCT program funds.

In January 1986, special U.S. and Canadian envoys issued a joint report (referred to as "the envoys' report") which contained several recommendations aimed at reducing the environmental problems associated with U.S., Canadian, and transboundary acid rain. Sulfur dioxide and nitrogen oxide emissions associated with coal combustion contribute to the formation of acid rain. The report recommended that the U.S. government implement a 5-year, $5 billion commercial demonstration program in which the federal government would provide up to half, or about $2.5 billion, of the funding to advance the types of technologies that would be needed for any future acid rain control program. The Innovative Clean Coal Technology program, or round two of the CCT program, grew out of the President's commitment on March 18, 1987, to request the full amount of the federal share of funding recommended by the envoys' report.

DOE, in a 1987 report to the Congress on the CCT program, stated that round two of the program would be directed at seeking new means of employing emerging clean coal technologies with the objective of reducing sulfur dioxide and/or nitrogen oxide emissions. DOE also stated an additional objective of improving the economics of using coal and seeking means of converting coal into forms that could allow its use as a cost-effective substitute for oil and natural gas. For round two of the program, the Congress appropriated a total of $575 million for fiscal years 1988-89. DOE has proposed an additional $1.5 billion in program funds for fiscal years 1990 through 1992.

## STATUS OF THE CCT PROGRAM

As of May 31, 1988, cooperative agreements totaling $227.5 million in federal financial assistance and $529.8 million in nonfederal financing had been finalized for seven projects. Two of the original nine projects were withdrawn because the sponsors could not formalize project financing or third-party agreements. The withdrawn projects were replaced with four others from an alternate list of eligible projects. DOE and the project sponsors have not finalized cooperative agreements for any of the replacement projects, but DOE expects to finalize those agreements by December 1988.

Of the seven projects now under cooperative agreements, one was scheduled for completion in early 1989, two were to be completed in late 1990, one in late 1991, one in early 1993, one in late 1993, and one in late 1994. As of May 31, 1988, three of the projects were on schedule, but the completion dates had been slightly delayed for the remaining four. Additional information on round one projects is presented in attachment I to my statement.

DOE issued the solicitation notice for round two project proposals on February 22, 1988, and received 54 proposals by the cut-off date of May 23, 1988. DOE expects to make its selections by October 30, 1988.

### Project Negotiation Problems

DOE officials planned to sign cooperative agreements with sponsors of the initially selected projects by April 1987, but only two agreements were finalized by that date. Delayed by negotiation difficulties, the other five agreements were finalized between June 1987 and January 1988.

According to DOE officials, project participants' difficulties in finalizing financial and other business arrangements caused major delays in completing and signing cooperative agreements and significantly contributed to the withdrawal of two of the originally selected projects. The cooperative agreements for the four projects that DOE rated as having "good" or "better" financial plans were completed in less time than the five other projects with lower ratings. Cooperative agreements for the latter five projects either took longer than 500 days to finalize or the project sponsors withdrew from the process. DOE officials initially planned to take about 247 days to finalize the agreements.

For round one, DOE established the policy that the government should recoup its investment in clean coal projects within 20 years after commercialization of individual projects. Recoupment was to come primarily from (1) the net revenues generated from project operations and (2) the revenues accruing from the commercial sale, lease, manufacture, licensing, or use of the demonstrated technology.

DOE officials stated that the recoupment provisions were not very well received by private-sector sponsors. The provisions created negotiation problems, which delayed the formalizing of one cooperative agreement and were a factor in the sponsor's withdrawal of another project. According to the project selection committee chairman, project sponsors generally did not want to be legally bound to repay the government if the demonstrated technology was ultimately commercialized, although sponsors of the seven projects ultimately agreed to this provision.

According to DOE, technical data rights determinations also caused some delays in formalizing cooperative agreements. DOE patent counsels in DOE headquarters and at the Oak Ridge Operations Office stated that although the participants were able to withhold technical data developed prior to the agreement from public disclosure, the participants were concerned that technical data resulting from the project would be subject to public disclosure.

According to a DOE patent counsel who assisted in the negotiations, resolution of technical data rights was important to the formalization of all five of the cooperative agreements he worked on. In addition, a DOE official noted that in the case of one withdrawn project, the inability of the parties to resolve technical data rights was a major cause for negotiation delays before the sponsors finally withdrew their proposal.

### Programmatic Changes in Round Two

Several major changes were made between the solicitations for round one and round two of the CCT program.

- Presidential direction shifted the focus of the program from a broad approach of funding varied technologies that could increase the use of coal while minimizing environmental impacts to a more focused objective of placing more emphasis on funding technologies that can achieve significant emissions reductions from existing coal-burning facilities.

- Statutory provisions expanded the program's cost-sharing provisions and time frames for selection. Some pre-award costs related to the preparation of material requested by DOE can be reimbursed to the sponsors for round two proposals. In addition, the length of time allowed for proposal submission and selection has been extended to 90 days and 160 days, respectively.

- Office of Management and Budget recommendations prompted

DOE to more precisely define recoupment provisions. Changes to the recoupment plan include adjusting the recoverable amount for inflation, specifying a federal share of 3 percent of the royalties arising from licensing, and specifying a 2-percent share for the government of gross sales revenues generated by the sale of equipment manufactured as a result of commercialization.

-- Lessons DOE learned during round one elevated the importance of financing and led to the establishment of mutually agreed upon negotiation milestones prior to award. In round one, DOE placed little weight on financing criteria and required participants to have their financial commitments in place for the entire project at the time of financial award. For round two, in recognition of the difficulty of securing all financing at the project's inception, DOE is giving significantly increased emphasis to financing criteria in its evaluation and selection process. DOE will only require in-place financial commitments through a project's preliminary design phase. In addition, DOE and the project sponsor will mutually establish a schedule for negotiation which will include specific milestones.

-- In response to the concerns of environmentalists, DOE plans to include an environmental analysis in its pre-award report to the Congress. The analysis would describe the potential environmental changes that may be produced regionally and nationally by the year 2010 if demonstration technologies are commercialized.

Generally, we believe that most of the changes are useful and should help alleviate some of the negotiation difficulties and attendant delays experienced during round one of the program. In addition, the objective has been more narrowly focused by virtue of DOE's plan to use criteria consistent with recommendations in the envoys' report and place emphasis on funding technologies that can lead to reduced sulfur and nitrogen oxide emissions from existing coal-burning facilities.

However, on the basis of our review of public comments regarding the solicitation and our discussions with cognizant public officials, it appears that problems related to technical data rights and participant dissatisfaction with, and objection to, recoupment provisions will continue to cause negotiation difficulties. Although DOE has attempted to address these issues, solutions to these problems are not yet apparent.

As part of its pre-award report to the Congress, DOE plans to include an analysis describing the maximum potential change in principal air emissions, water effluents, and solid wastes that could be produced based on commercial application of the demonstrated technology. However, DOE's current plan only calls for a general environmental discussion of the generic technology to be used for the project, and does not call for a specific discussion of the environmental impact of the particular project to be demonstrated.

In this regard, a Senate committee report on fiscal year 1987 appropriations stated that DOE should obtain project-specific data from the sponsors. The Congress would be better informed in reviewing a proposed project if specific data, including environmental impact data, were also included in DOE's report on the project. The inclusion of specific project data, in addition to the generic data, should not result in significant additional costs because DOE has already been requested to obtain this type of information from project sponsors.

## CONSISTENCY WITH ENVOYS' REPORT RECOMMENDATIONS

The envoys' report contained several recommendations aimed at reducing acid rain. The report recommended that the program give special consideration to retrofit technologies that could be applied to existing facilities that currently use high-sulfur coal so that some "near term" emissions reduction and acid rain abatement could be achieved.

Although there was no statutory requirement for round one to conform to recommendations of the envoys' report, considerable disagreement exists regarding the extent to which DOE's implementation of the CCT program has been consistent with recommendations of the envoys' report. A key factor in the debate centers around the retrofittability of specific projects.

DOE applies a broader definition of what constitutes a retrofittable application than does EPA. DOE has taken the view that the demonstrated technology will meet the envoys' definition of being retrofittable if it can make use of existing plant equipment such as the steam turbine. Accordingly, a project could be classified as a retrofit application even though the existing boiler was not utilized or the boiler required extensive modification. EPA's interpretation is based on the extent to which a demonstrated technology is retrofittable on existing coal boilers at minimal cost. EPA's definition is not limited to scrubbers, however, and can include other retrofittable technologies such as slagging combustors and sorbent injection processes.

Retrofittability determinations can influence program direction and focus. To illustrate, using DOE's classification of retrofit projects, we calculated that about $171 million for five projects, or approximately 75 percent of the federal financial assistance provided under round one of the program, was consistent with the envoys' recommendations regarding retrofittability. However, using EPA's retrofittability assessment, we calculated that only about $23 million for three projects, or about 10 percent of the financial assistance, was consistent with the envoys' retrofit recommendations.

DOE and EPA need to resolve their differences on what constitutes retrofit technologies because the controversy will likely take on greater significance for round two projects. The second round is more directly related to recommendations of the envoys' report.

## IMPACT OF PENDING LEGISLATION ON DOE'S CLEAN COAL TECHNOLOGY PROGRAM

The Congress has been debating whether acid rain-causing emissions can be reduced in the near term without impeding the development and commercialization of clean coal technologies. One key issue on which the debate centers is the need, and proper time, to mandate reduction controls in conjunction with amending the Clean Air Act, which regulates emissions of sulfur dioxide and nitrogen oxides. In order to obtain a balanced perspective about acid rain control and clean coal technologies, we met with environmental groups such as the Natural Resources Defense Council and Greenpeace, and supporters of the CCT program such as utility groups and the Electric Power Research Institute (EPRI).

The following topics discuss (1) acid rain control bills and how they relate to the CCT program, (2) the commercial availability of emerging technologies, (3) possible approaches for linking the commercial availability of clean coal technologies with emission reductions and compliance schedules contained in the bills, and (4) the question of whether the CCT program should be directly related to acid rain control legislation.

## Acid Rain Bills and the CCT Program

We identified 19 acid rain control bills that have been introduced since January 1987. Most would amend the Clean Air Act by requiring reductions of sulfur dioxide and nitrogen oxide emissions. Attachment II details key provisions of pending legislation regarding acid rain control.

The enactment of legislation that prescribes new deadlines and/or emission targets for controlling acid rain could affect the potential effectiveness of DOE's CCT program. For example, if legislative compliance deadlines are established to take effect before funded technologies are commercially available or if emission-reduction target levels are higher than they can attain, utilities may likely switch to low-sulfur coal, clean coal prior to combustion, or use scrubbers. Many CCT program supporters believe that utilities that incur the cost to comply with newly mandated emission reduction levels through investment in conventional technology, such as scrubbers, on existing plants would not subsequently expend additional resources to acquire newly emerged clean coal technologies for those same plants. Therefore, potential benefits of the CCT program could be unrealized.

Also, the scheduled demonstration completion dates for the seven funded projects range from early 1989 to late 1994. The legislative compliance dates of some pending legislation are as soon as the early 1990s. Therefore, some of these technologies may not even have been successfully demonstrated by the emission reduction compliance dates contained in some pending acid rain legislation.

In addition, even after the completion of the demonstration period for funded projects, an uncertain amount of time is required to bring the technologies to the point of commercialization. As noted in a recent EPRI study, none of the round one CCT program technologies is "on the market" today in the sense of being a mature technology with several units installed or ordered for commercial operation, and with well-defined cost, performance, and risk profiles. Further, when these technologies are commercially available, their deployment would involve cost decisions, and construction and public utility commission licensing could take several years.

## Commercial Availability

EPRI has estimated that for technologies similar to those being demonstrated under round one, the commercial availability dates range from 1992 to 2000, with most of the technologies potentially available in the mid-1990s. That time frame is consistent with the compliance date contained in many pending legislative proposals. However, EPRI pointed out that several demonstrations of each technology, as well as regulatory, financial, and other factors, will be involved in the overall process of commercializing these new technologies. EPRI's preliminary estimates of the commercial availability dates of various clean coal technologies are shown in attachment III.

DOE officials at the energy technology centers which are managing round one projects estimated that the first commercial application for six of the seven round one technologies for which agreements have been signed will occur from 1992 to 1995, and the seventh by the year 2000. (See attachment IV.) They cautioned, however, that these estimates are best-case scenarios. These estimates do not appear to leave much room for such things as regulatory or financing problems that may occur. In addition, according to DOE officials, these estimates do not take into account the conservative nature of most utilities in deciding on major capital expenditures.

## Legislative Approaches to Acid Rain Control

It may be advantageous to link the commercial availability of clean coal technologies with acid rain legislation. The Congress may, therefore, want to consider an approach that accommodates the concerns of both environmentalists and clean coal technology proponents. The Congress might, for example, establish compliance deadlines and emission reduction levels that allow for significant near-term reductions in emissions but are not so stringent as to deter the use of clean coal technologies aimed at the same goal.

One strategy that has been suggested to accommodate both sets of objectives is a phased-in approach whereby states or utilities would reduce their emissions in stages. An example of this approach is reflected in H.R. 2666, which would require an estimated 10-million-ton reduction in sulfur dioxide in two phases--the first phase by 1993, and the second by 1997. Nitrogen oxide reductions from stationary sources would be reduced by 2 million tons by 1997, with the remaining 2-million-ton reduction requirement to be achieved by mobile sources.

Proponents of this approach contend that costly decisions about the use of emerging technologies can be deferred until the success of these technologies is more certain. At the same time, small environmental benefits can be achieved earlier and continue to accrue incrementally. Critics, on the other hand, contend that the phased-in approach does not address the urgency with which the acid rain problem should be addressed. They further contend that there is significant potential for large-scale negative socioeconomic impacts on the high-sulfur coal mining industry because coal switching (from high- to low-sulfur coals) would probably be a primary means by which the smaller, near-term emission reductions would be achieved.

Another strategy included in H.R. 4331 would extend compliance deadlines for utilities that choose to use a developing technology to meet their emissions reduction target. This bill would authorize states to extend for up to 2 years the date by which utilities using clean coal technologies must meet emission reduction requirements. Under this approach, those utilities choosing to use existing technologies would have to start reducing emissions early. This provision is intended to satisfy the concerns of those who favor immediate acid rain controls. At the same time, it could also allow DOE to achieve its goal of clean coal technology commercialization by providing other utilities an incentive to use the technologies.

## Additional Guidance for the CCT Program

DOE is conducting the CCT program under broad statutory provisions which allow it to use wide discretion. The Congress may want to consider whether DOE needs additional congressional guidance on how the program should be implemented.

The CCT program is being conducted under the Energy Reorganization Act of 1974 and the Federal Nonnuclear Energy Research and Development Act of 1974. Since 1985, when the program was initiated, Senate and House appropriations committees have provided some direction through various appropriations actions.

Senate Report 98-578, which accompanied the act establishing the Clean Coal Technology Reserve account, stated that the proposed CCT program would support the goals of improving process efficiency, reducing capital costs, and enhancing environmental performance of various fossil energy technologies. A 1987 Senate appropriations committee report (Senate Report 100-165) stated that the purpose of the CCT program is to seek to accelerate the development of emerging clean coal technologies. Also, a House committee report on fiscal year 1987 appropriations (House Report 99-714) stated that not enough of the CCT program round one projects addressed emissions problems associated with existing power plants and expressed hesitancy in funding additional projects of the types funded in round one.

The broadly stated statutory provisions allow DOE to use wide discretion in implementing the CCT program for purposes other than emission reduction, such as improving process efficiency and reducing capital costs of fossil energy technologies. If the Congress wants the CCT program to be part of an acid rain control program, the Congress may want to include the program in acid rain control legislation. In any event, if acid rain control legislation is enacted without including the CCT program, DOE should review its program implementation to ensure that it is consistent with the goals and objectives of an acid rain control program established by the Congress.

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In summary, DOE has taken action to solve some problems experienced in round one of the CCT program, but others still remain. The major issue, however, is whether emerging clean coal technologies will be commercially available to achieve emission reductions or other requirements within the time frames established in any acid rain legislation the Congress may enact. While we are not expressing judgment on any of the pending bills, the Congress should take into consideration the potential role that emerging technologies funded under the CCT program can play in reducing emissions to control acid rain.

This concludes my prepared statement. We would be pleased to respond to any questions that you or Members of the Subcommittee may have.

ATTACHMENT I

ATTACHMENT I

## Round One Technology Demonstration Projects, P ect Sponsors, and Estimated Project Cost Shares

| | | ject Costs[a] | |
|---|---|---|---|
| Project | Sponsor | I | Sponsor |
| | | (millions) | |
| Advanced cyclone combustor | Coal Tech Corp. | $ 0.4 | $ 0.4 |
| Pressurized fluidized bed | American Electric Power Service Corp. | 0.2 | 107.3 |
| Limestone injection multistage burner | Babcock and Wilcox Company | 7.6 | 11.8 |
| Gas reburning and sorbent injection | Energy and Environment Research Corp | 15.0 | 15.0 |
| Prototype commercial coal/oil coprocessing plant | Ohio Ontario Clean Fuels, Inc. | 45.0 | 180.7 |
| Underground coal gasification | Energy International Inc. | 11.8 | 58.3 |
| Advanced integrated combined cycle power generation plant | The M.W. Kellogg Company | 87.5 | 156.3 |
| | Total | $227.5 | $529.8 |

[a] At the time that cooperative agreements were finalized.

ATTACHMENT II　　　　　　ATTACHMENT II

## ACID-RAIN-CONTROL BILLS PROPOSED SINCE JANUARY 1987

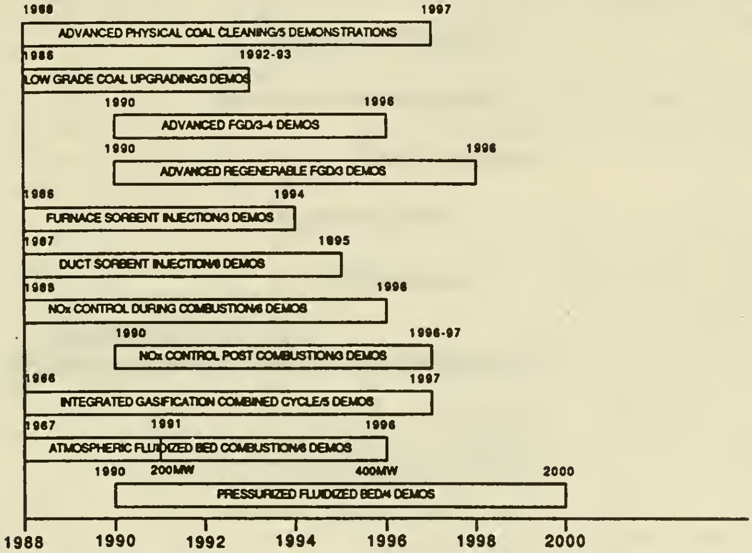
| | | Reduction Requirement | | |
|---|---|---|---|---|
| Number | Sponsor | Sulfur Dioxide (SO2) | Nitrogen Oxides (NOx) | Emphasis (if other than reduction requirement) |
| HR 1664 | Solomon | 10 mil tons below 1980 levels over eastern US in 2 phases—half by early 1991 and remainder by 1996 | not required but can be substituted for SO2 reductions on 2:1 ratio | |
| HR 1679 | Cheney | 10 mil tons below 1980 levels over eastern US in 2 phases—half by early 1993 and remainder by end of 1997 | not required | |
| HR 2133 | Walgren | N/A | N/A | prohibits sources in one state from interfering with another states' attainment of air quality |
| HR 2355 | Scheuer | N/A | N/A | authorizes research on acid rain |
| HR 2399 | de la Garza | N/A | N/A | establishes 10-year program to document threat from acid rain |
| HR 2423 | Torres | N/A | N/A | requires new stationary sources of air pollution located in attainment areas to periodically reduce emissions |
| HR 2497 | Gregg | N/A | N/A | amends the Internal Revenue code to impose excise tax on SO2 and NOx emissions |
| HR 2498 | Gregg | N/A | N/A | similar to HR 2497 but additionally authorizes an acid rain control program and requires studies of effectiveness of tax in reducing pollution |
| HR 2666 | Sikorski | 10 mil tons below 1980 levels nationwide in 2 phases—half by 1993 and the balance by 1997 | 4 mil tons by 1997 | |
| HR 3632 | [illegible] | 10 mil tons in 2 phases—1994 and 1999 | 3 mil tons by 1999 | |
| HR 4331 | Cooper | 10 mil tons below 1980 levels nationwide phased in by 2004 | 3 mil tons below 1980 levels nationwide phased in by 2004 | |
| S 95 | Kerry | 12 mil tons below 1980 levels over contiguous states in 2 phases—seven/twelfths by 1992 and the balance by 1995 | 3 mil tons by 1995 over contiguous states | |
| S 300 | Stafford | no specific reduction required but strategy would result in 12-million-ton reduction below 1980 levels nationwide during the early mid-1990s | no specific reduction required but strategy would result in some NOx reductions by 1995 | |
| S 316 | Proxmire | 10 mil tons over US in 2 phases—1993 and 1997 | 3 mil tons over eastern US states by 1997 | |
| S 321 | Mitchell | 12 mil tons below 1980 levels by 1996 over 50 states | 4 mil tons below 1980 levels by 1996 over 50 states | |
| S 796 | Durenberger | N/A | N/A | requires EPA to establish new standards for SO2 and NOx |

ATTACHMENT II

ATTACHMENT II

| | | Reduction Requirement | | |
|---|---|---|---|---|
| Number | Sponsor | Sulfur Dioxide (SO2) | Nitrogen Oxides (NOx) | Emphasis (if other than reduction requirement) |
| S 911 | Durenberger | N/A | N/A | implements recommendations of Special Envoys to authorize a program deploying clean coal technologies and to reduce transboundary air pollution |
| S 1123 | Durenberger | 12 mil tons nationwide below 1988 levels in 2 phases—by 1994 and 1997 | 4 mil tons nationwide below 1980 levels in 2 phases—by 1994 and 1997 | |
| S 1894 | Mitchell | 12 mil tons nationwide below 1980 levels in 3 phases—5 mil by 1993, 5 mil by 1998, and 2 mil by 2000 | 4 mil tons nationwide by 1996 | |

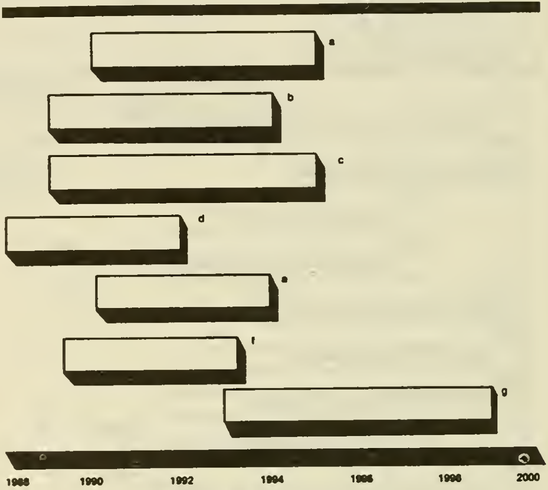
## ESTIMATED COMMERCIAL AVAILABILITY DATES OF CLEAN COAL TECHNOLOGIES



**START DATE LINE = FIRST COMMERCIAL DEMONSTRATION PLANT ORDER**
**END DATE LINE = AVAILABLE FOR COMMERCIAL USE**

Source: Electric Power Research Institute

**Estimated Timelines for First Commercial Applications of DOE CCT Projects**



[a] Underground Coal Gasification/Energy International, Inc.
[b] Pressurized Fluidized Bed Combustor/American Electric Power Service Corp.
[c] Advanced Integrated Combined Cycle Power Generation Plant/M.W. Kellogg Co.
[d] Advanced Cyclone Combustor/Coal Tech Corp.
[e] Gas Reburning and Sorbent Injection/Energy and Environment Research Corp.
[f] Limestone Injection Multi-stage Burner/Babcock and Wilcox
[g] Prototype Commercial Coal/Oil Co-processing Plant/Ohio Ontario Clean Fuels. Inc.

Start Date Line—Commercial User Decision to Use Technology
End Date Line—Initial Commercial Operation

Source: DOE Technology Centers

(308795)

Mr. SHARP. Thank you, Mr. Sprague.

The Chair would now like to recognize our colleague from Ohio and a colleague from the Appropriations Committee. Mr. Regula has had a long-standing interest in the clean coal technology program. We would be happy to hear from him now.

## STATEMENT OF HON. RALPH REGULA, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF OHIO

Mr. REGULA. Thank you, Mr. Chairman. I appreciate the courtesy of both yourself and the committee members in allowing my statement to be made a part of the record.

I am pleased to have the opportunity to speak on the question of proposed acid rain legislation and the use of clean coal technologies. As you may know, I have testified in the past in opposition to proposed acid rain controls. Today, I am in even stronger opposition to those proposals.

Mr. Chairman, I would state that we have an acid mitigation program, and that is the Clean Coal Program. To date, the Congress has appropriated some $975 million specifically aimed at providing improved technologies for the control of sulfur and nitrogen oxide emissions from existing coal-burning facilities, and the House Interior bill that will be before the full House next week has an additional $100 million, and I think the Senate may well have more. It would be a travesty to waste this substantial investment before we have given the technological approach a fair chance.

I also add that in Ohio the voters supported a $100 million bond issue to develop clean coal technology with about two to one. This action is indicative of public support for the program.

I want to highlight the issue of $NO_x$. Conventional scrubbers only address $SO_2$. They do not remove nitrogen oxides, a source of growing concern to ozone deterioration, and we have all seen recent statements on many of the cities that are in noncompliance on ozone. Most clean coal technologies will have the added benefit of reducing $NO_x$ as well as $SO_2$. As I am sure the subcommittee is aware, nitrogen oxides interact with sunlight to form and/or break down ozone. Ozone pollution is a major health problem in urban areas, many of which did meet the attainment for ozone by the December 1987 deadline.

In addition to posing a serious health threat to individuals suffering from respiratory illnesses, high levels of ozone can also be substantially injurious to animals and damage crops, forests, and manmade materials.

Returning to the Clean Coal Program, the Secretary of Energy is directed to consider two things above all: (1) the extent of total potential emissions reductions by a technology based on existing facilities and, (2) in evaluating the second round of clean coal proposals, if reduction potential is similar among technologies, the cost per ton of emissions reduced.

As in the first round of clean coal projects, the private sector must provide a minimum of 50 percent of the cost of a project and must repay the Government if revenues are available. I might say that if we had done that with synthetic fuels we probably would have had a lot more success. In fact, the cost sharing under the first solicitation has resulted in an average private sector contribution of 65 percent, which means the private sector has a great deal of confidence in these programs.

The Clean Coal Program will greatly enhance the development of a variety of technologies capable of reducing emissions from and increasing the efficiency of existing facilities. We can benefit the environment and the ratepayers if this program is allowed to proceed in an orderly manner, and, with the grid interlocks that exist today, ratepayers are going to be impacted not only in the Midwest but throughout the Nation because a significant amount of power flows from the Midwest to the Northeast in periods of shortage.

Let me talk for a moment about the ratepayers. A study by James Cannon entitled Controlling Acid Rain: A New View of Responsibility: concludes that much of the imported power on which the Northeast relies may be coming from Midwestern plants. California was the Nation's largest power importer by volume in 1984. California power imports alone amounted to more electricity than was consumed by all customers in any of 35 States.

What this highlights is that, to the extent that electricity is consumed and paid for by people living in States other than where the power is generated, costs associated with power generation, including acid rain, control costs, may well be largely passed on through electricity sales contracts to these out-of-State customers in the Northeast and California.

In other words, as the Cannon study concludes, many of the so-called acid rain producing States are serving as, and I quote from his study "the Nation's electricity breadbasket supplying power to other States with fewer operating plants relative to their demand." This power does not come free of an environmental price tag. The importers of coal-fired power are the direct beneficiaries of its generation and should share the responsibility for paying for any solution to the acid rain problem.

The Clean Coal Program offers an equitable way of sharing costs and achieving the desired environmental results. On the other hand, the proposed acid rain legislation would bring the Clean Coal Program to a halt. The most cost-effective, permanent solution to reduce both $SO_2$ and $NO_x$ emissions is in the widespread commercial use of emerging clean coal technologies.

Proposed regulatory programs may achieve reductions faster than the use of clean coal technology but at much greater cost in dollars and jobs than if these are not sustained.

As coal use increases, industry would be forced to use current generation technologies which are not as efficient or cost-effective as the new clean coal technologies since the cost to comply with an acid rain program would siphon off moneys that could otherwise be used to demonstrate and deploy more efficient, cleaner technologies.

The rapid and widespread commercialization of promising new clean coal technologies will yield important national benefits: environmental integrity, protection of domestic coal markets, energy independence, and cost-effective electric power.

The best way to assure rapid and widespread commercialization of these technologies is by expanding the unique and productive

Federal Government/private sector partnership established by the DOE Clean Coal Program.

One final point I would like to make, is that the proven coal reserves in the United States are the equivalent of 1.5 trillion barrels of oil in terms of Btu's. It would be a tragic national policy, especially with our desire for energy independence and the cost of oil from the Persian Gulf, to not utilize these resources.

We produce 56 percent of our electricity with coal today. The balance is about 17 percent from nuclear power, a small amount of hydro; and the rest is oil and gas. It is a wasteful use of a national asset to consume oil and gas for electricity generation, which we need for transportation and for home heating. The clean coal technology offers the way in which we can utilize that 1.5 trillion barrels equivalent of oil to produce electricity in a way in an environmentally safe and a commercially effective program and do it at a cost that the ratepayers can be competitive.

Again, I thank you, Mr. Chairman, for your courtesy and the opportunity to participate.

Mr. Sharp. Thank you very much. We are always happy to hear from you and know of your strong and deep involvement on the Appropriations Committee and elsewhere in the Congress on this issue. We are happy to have you with us.

We will now return to our panel of witnesses. We are very happy to have Mr. Siegel representing the Department of Energy.

## STATEMENT OF JACK S. SIEGEL

Mr. Siegel. Thank you. Good afternoon, Mr. Chairman and members of the subcommittee. I appreciate this opportunity to discuss today the clean coal technology program and its relationship to acid rain legislation.

As a result of the more than $60 billion spent by utilities in the last decade and a half and the additional billions spent by others, sulfur dioxide emissions have declined dramatically. Since the Clean Air Act amendments were passed in 1970, U.S. sulfur dioxide emissions have dropped about 28 percent from their peak in 1973. Coal-fired powerplants nationwide have reduced their $SO_2$ emissions by 11.4 percent from their 1977 peak through early 1987. This has occurred even as coal consumption was increasing dramatically from 389 million tons per year in 1973 to 693 million tons per year in 1985.

Future significant declines in $SO_2$ are also expected as old, higher emitting plants are retired and/or utilized less and are replaced by new plants meeting new source performance standards and best available control technology emission levels. However, current technological options for further control of $SO_2$ from existing plants are limited to coal preparation, coal switching, and flue gas scrubbing, each possessing their own particular problems.

A new generation of advanced coal technologies, the clean coal technologies, now emerging from the research and development process offer the potential for significant economic, performance, and environmental advantages for the wide variety of market needs that now exist. Their utility will be even more apparent in the future. In fact, as the Electric Power Research Institute, DOE, and others have agreed, if given the opportunity to be demonstrated and commercially deployed, these technologies would result in deep and sustained reductions in $SO_2$ and possibly nitrogen oxides emissions through normal market forces.

The suite of clean coal technologies address the problems of emissions control through pre-combustion cleaning of coal, new coal combustion techniques which inherently remove $SO_2$ and $NO_x$, post-combustion cleanup of coal combustion gas streams, and coal conversion systems which convert coal to clean liquids and gases for various market uses.

Most of the technologies can be applied to existing sources for pollution control, power generation, and/or conversion from oil or gas to coal. They can also be used for new grass-roots facilities to produce power, generate steam, or even run locomotives. Many of these technologies can likely be combined to meet market needs more cost-effectively and efficiently with excellent environmental benefits. More information on the benefits of the clean coal technologies is provided in my written statement.

DOE anticipates that life-cycle costs of the advanced clean coal technologies are projected to be lower than conventional technology. However, providing a precise cost estimate may not be possible at this time. This is because cost is directly related to the process configuration used, site specific factors such as land availability, boiler type, age and size, coal type used, ducting available, and existing pollution control equipment, among others.

Some generalizations can be made, however. Estimates for the costs and performance of retrofitting and powering existing facilities with conventional and advanced technologies are provided in figure 15 of America's Clean Coal Commitment which the Department of Energy published in February of 1987.

In addition, more detailed cost and performance estimates for integrated gasification combined cycle and pressurized and atmospheric fluidized bed combusters were provided in DOE's December 1987 report, The Role of Repowering in America's Power Generation Future.

With the committee's approval, I would like to provide the two reports for the record.

The likelihood of significant economic improvements is high with these new suite of technologies. However, it must be kept in mind that these advanced coal technologies are not yet commercially proven. Until they are demonstrated, in some cases demonstrated in multiple units, cost and performance information, and therefore vendor guarantees, will remain uncertain.

When the advanced clean coal technologies will be commercially deployed is a difficult question to answer as several barriers to their demonstration and deployment exist. Regulated U.S. utilities are, in general, risk averse. They are in the business to produce reliable power at a reasonable cost. Under the current regulatory climate, regulated utilities receive little, if any, reward for risk taking. Since utilities are not rewarded for taking risks and may even be penalized for taking risks that result in failure, even the most promising technologies will not be used in large quantities until commercial scale reliability and performance are assured and the regulatory climate is more conducive to the introduction of emerging technologies.

To reduce the risks of new technology to an acceptable level, demonstrations and, in some cases, several demonstrations of the same or similar technology may be needed. The number of replications needed depends upon the technology and the specific use being proposed.

Figure 14 in America's Clean Coal Commitment provides the estimated dates that initial demonstrations for a variety of generic clean coal technologies are expected to be completed. Several additional steps would then be required. The time required for the design, permitting, construction, and shakedown of the next demonstration or the first commercial prototype would add 3 to 5 years to the dates shown in figure 14. If further replications are required, additional time must be added to finally arrive at the dates the technologies will be generally accepted for commercial deployment.

Because of the economic and performance improvements the clean coal technologies offer, in time they may be deployed in considerable numbers through current market forces. This applies both to the power generation repowering technologies and the retrofit pollution control technologies. However, the rate of deployment will be dependent upon many factors, such as future energy prices, competition, results, number and timing of the demonstrations required, the regulatory climate, the growth in demand for electricity, and the availability of incentives for accelerating demonstration and deployment.

Utility and industrial concerns have limited funds available for research, development, and demonstration. If acid rain control legislation is enacted, these funds will be redirected towards compliance with the added control requirements. Compliance would be achieved by conventional technologies because they are less risky. Even though their costs may be higher than clean coal technologies', these costs can be passed through to the consumer. In addition, they would more likely pass State prudency reviews because they are known and proven technologies. This, in turn, will result in a near-term, very costly patching of an environmental problem for which scientists have yet to reach a consensus on either its magnitude or its remedy.

The pace of development of more efficient, extremely clean advanced technologies which have the potential to resolve more cost-effectively and for the long term any problems that $SO_2$ and nitrogen oxides may be causing will be slowed, if not altogether halted.

As I have just discussed, premature enactment of acid rain control legislation would have a very serious and lasting impact on the demonstration and deployment of clean coal technologies. Therefore, the most prudent actions that can be taken to ensure the future availability of clean coal technologies are, first, to continue funding of the coal technology research and demonstration programs consistent with the President's fiscal year 1989 budget request. This will ensure that promising technologies currently ready for demonstration or in the research and development pipelines are demonstrated by the 1990's; second, defer consideration of acid rain control legislation until the scientific evidence and cost-benefit analyses warrant further controls.

The interim NAPAP assessment indicated that currently there is no reliable way to predict the outcome of any given regulatory action, and therefore the administration suggests that it would not be appropriate to enact new legislative controls until their actual effects could be reasonably predicted. In addition, sulfur dioxide emissions have been declining and should decline even more dramatically in the future, especially if clean coal technologies can be demonstrated and deployed.

Third, provide incentives for the demonstration and early deployment of clean coal technologies. Incentives to reduce risks and provide rewards for utilities regulated by the Federal Energy Regulatory Commission to encourage States to adopt incentives and to remove barriers caused by certain environmental regulations have been recommended by the President's Task Force on Regulatory Relief, chaired by the Vice President, and accepted by the President.

These and others that may be identified by the Department of Energy's Innovative Control Technology Advisory Panel in a study they are now conducting for the Secretary of Energy should act to level the playing field for innovative technologies and therefore encourage and accelerate the demonstration and deployment of promising advanced technologies.

This concludes my formal statement, Mr. Chairman. I would be happy to answer any questions you and the subcommittee members may have. Thank you.

[Testimony resumes on p. 477.]

[The prepared statement of Mr. Siegel follows:]

Statement of Jack Siegel
Deputy Assistant Secretary
for Coal Technology
U. S. Department of Energy
Before the
Subcommittee on Energy and Power
Committee on Energy and Commerce

June 22, 1988

Good morning Mr. Chairman and members of the Subcommittee. I appreciate this opportunity to discuss today the Clean Coal Technology Program and its relationship to acid rain legislation.

With the Subcommittee's approval I would like to take a few minutes to describe the downward trends in emissions that have occurred over the last decade. As requested by the Subcommittee, I would then like to discuss the advantages advanced clean coal technologies offer over conventional technology to further reduce emissions in the future, the projected economics of these advanced systems, when they will be commercially available, the barriers to their deployment, the effect that acid rain control legislation would have on their development and commercial deployment and actions that should be considered to ensure the availability of these advanced technologies.

As a result of the more than $60 billion spent by utilities in the last decade and a half and the additional billions spent by others, sulfur dioxide emissions have declined dramatically. Since the Clean Air Act was passed in 1970, U.S. sulfur dioxide (SO2) emissions have dropped about 28 percent from their peak in 1973. Coal-fired power plants nationwide have reduced their SO2 emissions by 11.4 percent from their 1977 peak through early 1987. This has occurred even as coal consumption was increasing dramatically, from 389 million tons per year in 1973 to 693 million tons per year in 1985.

Sulfur dioxide emissions reductions from coal-fired power plants in the northeastern U.S., the region receiving the most attention in the acid rain debate, have been even more dramatic, dropping by 19 percent from 1975 to 1984 even as coal consumption in this region increased 23 percent.

Future significant declines in SO2 are also expected as old, higher emitting plants are retired and/or utilized less and are replaced by new plants meeting New Source Performance Standards and Best Available Control Technology emission levels. However, current technological options for further control of SO2 from existing plants are limited to coal preparation, coal switching and flue gas scrubbing.

Conventional coal preparation, used today to clean about 2/3 of the coal produced east of the Mississippi River, can only remove 20 to 40 percent of the pyritic sulfur or 10 to 30 percent of the total sulfur in coal.

Switching from high sulfur coal to lower sulfur coal, although presently a moderately inexpensive control option for some plants, would result in the dislocation of coal miners and concomitant adverse regional economic impacts.

Flue gas scrubbing, although effective for controlling high percentages of SO2, is very costly both economically, where the cost of a scrubber could exceed the cost of the boiler it would be installed on, and in performance efficiency, where it would drain 5 to 8 percent of the energy produced by a power plant. In addition, none of these options do anything for the control of NOx, another pollutant on which debate focuses.

A new generation of advanced coal technologies -- the Clean Coal Technologies -- now emerging from the research and development process, offer the potential for significant economic, performance and environmental advantages for the wide variety of market needs that now exist. Their utility will be even more apparent in the future. In fact, as the Electric Power Research Institute (EPRI), DOE and others have agreed, if given the opportunity to be demonstrated and commercially deployed, these technologies would result in deep and sustained reductions in SO2 and possibly NOx emissions through normal market forces.

## Advantages of Clean Coal Technologies

The suite of Clean Coal Technologies address the problems of emissions control through precombustion cleaning of coal, new coal combustion techniques which inherently remove SO2 and NOx, post combustion cleanup of coal combustion gas streams, and coal conversion systems which convert coal to clean liquids and gases for various market uses. Most of the technologies can be applied to existing sources for pollution control, power generation, and/or conversion from oil or gas to coal. They can also be used for new, grass roots facilities to produce power, generate steam, or even run locomotives. Many of these technologies can likely be combined to meet market needs more cost-effectively and efficiently, with excellent environmental benefits.

The new clean coal power generating technologies which inherently control pollution as part of the process include Integrated Gasification Combined Cycle (IGCC), and Pressurized and Atmospheric Fluidized-Bed Combustion, among others. They have the potential to offer thermal efficiencies of 45 to 50 percent as compared with 36 percent for conventional pulverized coal fired boilers with scrubbers.

They will not only meet, but exceed, federal New Source Performance Standards (NSPS). For example, IGCC has a proven capability of 99 percent sulfur dioxide removal. Fluidized-bed combustion combines 90 to 95 percent SO2 removal with NOx emissions 50 percent lower than NSPS.

Some advanced power generating technologies can be shop fabricated and built in modules of 100 to 300 MWe. This allows utilities to look at a short time horizon in estimating their power generation needs and to reduce considerably the capital required during construction. They are fuel flexible in that they can burn any grade of coal and, in some cases, waste materials, wood, and other fuel types.

These technologies can be used not only for the generation of electricity at new, grass-roots sites but can repower existing facilities to increase their power output, reduce emissions and extend its useful life. This option can resolve many of the problems likely to be encountered in siting new plants while at the same time improving the availability and reducing the emissions of older, inefficient boilers. For example, Integrated Gasification Combined Cycle technology, when used to repower an existing coal boiler, can increase the power output by 150 to 170 percent, reduce SO2 emissions by 99 percent and extend the life of the plant by up to 30 years.

Retrofit technologies such as Advanced Combustors, Coal Water Slurries, In-Duct Sorbent Injection, Reburning, Limestone Injection Multistage Burners. Advanced Coal Cleaning, and others, by themselves or in combination, have the potential to:

1) Control NOx as well as SO2

2) Reduce the costs and energy penalties of pollution control

3) Apply to the full range of existing boilers, including those that are site constrained

4) Apply to the full range of U.S. coals

5) Produce wastes that will be more benign, marketable, or easily disposed of than those produced using present control techniques.

DOE'S Coal Program consists of two major elements -- the research and development (R&D) program and the demonstration program. The R&D program supports basic and applied long-term, high-risk research through proof-of-concept scale. It is the technological pipeline which feeds the other major element of the program, the clean coal technology demonstration program. The demonstration program acts as the bridge between R&D and commercial deployment of the technologies. Its goal is to collect the technical, economic, environmental and other information needed for private sector commercialization decisions to be based. Risk-sharing is accomplished by the Department of Energy providing up to 50 percent of the cost of each demonstration project and private industry providing the remainder.

## Economics of Advanced Clean Coal Technologies

DOE's projections indicate that the anticipated life-cycle costs of the advanced clean coal technologies will likely be lower than conventional technology. However, providing precise cost estimates may not be possible at this time. This is because cost is directly related to the process configuration used, site specific factors such as land availability, boiler type, age and size, coal type used, ducting available, existing pollution control equipment, etc. As an example of the difficulty of estimating costs, we looked at the costs of the same sized scrubber having the same characteristics but installed at two different sites to find the capital costs differing by 25 percent.

Some generalizations can be made, however. Estimates for the costs and performance of retrofitting and repowering existing facilities with conventional and advanced technologies are provided in Figure 15 of America's Clean Coal Commitment, which the Department of Energy published in February 1987. In addition, more detailed cost and performance estimates for Integrated Gasification Combined Cycle and Pressurized and Atmospheric Fluidized-Bed Combustors were provided in DOE's December 1987 report The Role of Repowering in America's Power Generation Future. With the Committee's approval, I would like to provide the two reports for the record.

Cost estimates other than those cited in the two reports just referenced are frequently discussed. For example, a common estimate for the cost of a large, 1000 MWe coal-fired power plant with a scrubber is about $1500 per kw. Based upon the technology demonstrated at the Cool Water plant in Daggett California, the Electric Power Research Institute has quoted cost estimates in the range of $1300-1500/kw for IGCC. DOE's study "The Role of Repowering in America's Power Generation Future" suggested $1156/kw for an IGCC system employing hot gas cleanup. Estimates for advanced IGCC systems with hot gas cleanup have been cited by M.W. Kellogg and General Electric as having the potential to drop below $1000/kw when these systems are commercially deployed.

Although the likelihood of significant economic improvements is high with this new suite of technologies, there is no easy answer to the cost question. More importantly, it must be kept in mind, that these advanced coal technologies are not yet commercially proven. Until they are demonstrated, in some cases demonstrated in multiple units, cost and performance information and therefore vendor guarantees will remain uncertain.

## Commercial Availability of Advanced Clean Coal Technologies and Regulated Utility Risk Averseness

When the advanced clean coal technologies will be commercially deployed is a difficult question to answer as several barriers to their demonstration and deployment exist.

Regulated U.S. utilities are, in general, risk averse. They are in business to produce reliable power at a reasonable cost. Under the current regulatory climate, regulated utilities receive little if any reward for risk taking. New technologies may offer all the ingredients today's utilities require -- modularity, environmental acceptability, reduced construction time, and improved performance resulting in improved economics and in the long run, reduced risks. However, since utilities are not rewarded for taking risk and may even be penalized for taking risks that result in failure, even the most promising technologies will not be used in large quantities until commercial-scale reliability and performance are assured and the regulatory climate is more conducive to the introduction of emerging technologies.

To reduce the risks of new technology to an acceptable level, demonstrations and in some cases several demonstrations of the same or similar technology may be needed. The number of replications needed depends upon the technology and the specific use being proposed.

Figure 14 in America's Clean Coal Commitment provides the estimated dates that initial demonstrations for a variety of generic clean coal technologies are expected to be completed. Several additional steps would then be required. The time required for the design, permitting, construction and shakedown of the next demonstration or the first commercial prototype would add 3 to 5 years to the dates shown in Figure 14. If further replications are required, additional time must be added to finally arrive at the dates the technologies will be generally accepted for commercial deployment.

Because of the economic and performance improvements the clean coal technologies offer, in time they may be deployed in considerable numbers through current market forces. This applies both to the power generation/repowering technologies and the retrofit/pollution control technologies. However, the rate of deployment will be dependent upon many factors such as future energy prices; competition; results, number and timing of the demonstrations required; the regulatory climate; the growth in demand for electricity; and the availability of incentives for accelerating demonstration and deployment.

## Effect of Acid Rain Legislation on CCT Deployment

A considerable amount of money and risk is involved in the demonstration and initial deployment of any new technology. As previously mentioned, utilities are risk averse because incentives currently do not exist that warrant risk taking by regulated utilities. This is true even for technologies that could reduce life-cycle costs for utilities and ratepayers.

In addition, limited discretionary funds are available for utilities and others for research.

As a result, if acid rain legislation is enacted in the next few years, the limited private sector research funds available for new technologies would very likely be redirected towards compliance with the added control requirements and away from the development of advanced technology. In addition, compliance would come from the installation of less risky, conventional technology, even if its cost is likely to be significantly higher than advanced, albeit riskier technological options because these costs can be passed through to the consumer. Lower risk decisions will win out over investment in improved technology. This in turn will result in a near term very costly patching of an environmental problem for which scientists have yet to reach a consensus on either its magnitude or its remedy. The pace of development of more efficient, extremely clean advanced technologies which have the potential to resolve more cost-effectively in the near future any problems that SO2 and NOx emissions may be causing will be slowed if not altogether halted.

## Acid Rain Control vs. Clean Coal Technology

As I've just discussed, premature enactment of acid rain control legislation would have a very serious and lasting impact on the demonstration and deployment of clean coal technologies. Therefore, the most prudent actions that can be taken to ensure the future availability of clean coal technologies are:

1. Continue funding of the coal technology research and demonstration programs consistent with the President's FY 1989 budget request. This will ensure that promising technologies currently ready for demonstration or in the research and development pipeline are demonstrated by the 1990's.

2. Defer consideration of acid rain control legislation until the scientific evidence and cost-benefit analyses warrants further controls. The interim NAPAP assessment indicated that currently there is no reliable way to predict the outcome of any given regulatory action, and therefore, the Administration suggests that it would not be appropriate to enact new legislative controls until their actual effects could be reasonably predicted. In addition, SO2 emissions have been declining and should decline even more dramatically in the future, especially if CCT's can be demonstrated and deployed.

3. Provide incentives for the demonstration and early deployment of clean coal technologies. Incentives to reduce risks and provide rewards for utilities regulated by Federal Energy Regulatory Commission, to encourage states to adopt incentives, and to remove barriers caused by certain environmental regulations have been recommended by the President's Task Force on Regulatory Relief chaired by the Vice President and accepted by the President. These and others that may be identified by DOE's Innovative Control Technology Advisory Panel in a study they are now conducting for Secretary of Energy Herrington should act to level the playing field for innovative technologies and therefore encourage and accelerate the demonstration and deployment of promising advanced technologies.

This concludes my formal statement. Mr. Chairman, I would be happy to answer any questions you and the Subcommittee members may have. Thank you.

Mr. Sharp. Thank you very much, Mr. Siegel.

We now welcome Mr. Yeager with the Electric Power Research Institute.

## STATEMENT OF KURT E. YEAGER

Mr. Yeager. Thank you, Mr. Chairman, members of the committee. I am Kurt Yeager, and I am vice president of the Electric Power Research Institute and director of its Coal Combustion Systems Division.

Over the past decade, the utility industry and the Electric Power Research Institute have spent more than a billion dollars bringing the technology that we know now today as clean coal technology to the point where we can seriously consider it as a commercial option, and, indeed, we plan to spend at least $2 billion more in the coming years to reduce this range of technologies to commercial maturity.

This investment is being made, first and foremost, because coal is and will remain the most important fuel source for our Nation's electricity-based economy. Further, this emphasis recognizes two important points: first, the progress that has been made over the past 15 years in environmental control, indeed, a level of progress unparalleled anywhere in the world. This progress, together with the scientific evidence on the issues that has been previously reported to this committee indicates that the Nation should be concentrating on the most effective, sustained strategy to continue the progress already made while minimizing negative environmental and economic side effects.

Second, the importance of this effort to the ratepayer and consumer as well as the utility industry itself is underscored by the fact that a new conventional coal-fired powerplant will typically have more than a third of its costs invested directly in environmental control, a cost burden that is unacceptable in a global economy.

Therefore, my responses to the questions posed by the committee conclude the following: one, that innovative clean coal technology is being and will be productively used in the absence of additional control requirements; second, that innovative clean coal technology provides the opportunity to significantly reduce the cost and increase the effectiveness of environmental programs; third, the requirements and timing of emission control programs can discourage and even preclude the use of innovative clean coal technology; and, four, the prompt and successful achievement of the advantages of these technologies depends, first, on stable environmental policies that enhance productivity; effective risk-sharing programs; and avoidance of counterproductive compliance schedules.

Therefore, a national strategy which encourages the broadest and most productive use of innovative clean coal technology is not only the best way to sustain the environmental progress we have made but, in my judgment, the only practical way, and I would like now to briefly expand on these conclusions.

First and foremost, the foundation for the use of innovative clean coal technology is reduced cost. As this advantage is demonstrated in terms of both performance and reliability, the coal user is aggressively adopting the results. Specific examples include fluidized bed combustion, advanced flue gas control techniques for sulfur oxide control, low nitrogen oxide combustion modifications, and coal cleaning.

Simply stated, clean coal technology is intended to resolve what has been the long-standing policy conflict between coal use and the environment and therefore has pursued two primary objectives that I think it is important to keep separated: first, to provide improved coal utilization alternatives for both new and repowering plant applications, and, second, to provide an array of retrofitable emission control options in the event that science and public policy demonstrate that they are required.

It should be noted that this first objective has the potential to reduce the absolute cost and increase the productivity of power generation and should be given top priority from both an environmental and economic perspective.

This commitment by the industry is underscored by the recent response to phase two of the DOE-cosponsored innovative clean coal technology demonstration program. Of the 54 proposed demonstrations, 37 are directed to utility applications involving some 26 utilities that provide nearly 70 percent of the Nation's potentially affected coal-fired generating capacity; 17 technology categories are represented, and 12 are directed to retrofit applications.

Innovative clean coal technologies typically have several characteristics in common which determine their advantages relative to existing options: first, better integration of emission control, integration not only with the power generation process itself but also a more holistic integration of the environmental issues that face coal today and in the future; second, simplified process design; third, improved flexibility addressing a broader range of coal types as well as flexibility in size and site-specific requirements; and, finally, reduction of by-products which are more easily managed and potentially even marketable.

The cost savings accruing to this range widely but are typically in the capital range, from 10 to 80 percent, and translate into annual cost savings in the range of 20 to 30 percent. Because these benefits are primarily achieved through regulated utilities, they will flow directly to the ratepayer and to the consumer.

The savings in what we believe the most productive application to new and repowering plants over the next 15 years would exceed some $60 billion in capital costs, and if there were requirements on a retrofit basis they would reduce the costs on an annual basis of a control strategy by over $1 billion per year.

We believe that this type of scenario can ultimately achieve and, most importantly, sustain a level of emission reduction exceeding that of retrofit emission control approaches, the focus on new and repowering, and assures sustained environmental progress rather than the short-term illusion of progress.

Several principles are important in a strategy intended to encourage the use of innovative clean coal technology: (1) to sustain as a national priority the remarkable progress made over the past 15 years in emission reduction; (2) to reinforce a scientific basis for environmental quality goals and eliminate the continuing threat of administrative ratcheting of control regulations; (3) achieve environmental quality goals with the least impact on cost and productivity—while this certainly will encourage clean coal technology, the idea is not to limit the market to clean coal technology but assure that we have got the market flexibility to use on a site-specific basis the least cost control option and coal use option that we require; (4) to provide the schedule and risk-sharing flexibility commensurate with the realistic commercial maturation and market potential of new technology; (5) to establish a joint Federal and State Government commitment fostering clean coal technology as a prudent investment in the national interest and remove governmentally-imposed disincentives to their use; (6) permit the broadest possible averaging of emission reductions consistent with the achievement of environmental quality goals; (7) to recognize the negative cost-effectiveness impact of excessive levels of emission control, and, (8) to complete the ongoing DOE-cosponsored demonstration initiative as planned.

Assuming no further delays in the implementation of this initiative, we would expect commercial maturity to be achieved in the time frame of 1994 through the year 2000, depending upon the specific technology involved. At that point, the technologies are ready to compete on their economic merits in the marketplace.

Full utilization potentially would involve a market of more than 150,000 megawatts of new and repowering capacity just during the latter part of this century and the first decade of the next and up to 150,000 megawatts of existing capacity.

This market will require one of the largest and most concentrated construction efforts ever undertaken, and I think that is what we all must consider most carefully in terms of how we invest our national resources.

For example, the iron and steel equivalent of 200 nuclear aircraft carriers would be involved and the concrete equivalent of a coast-to-coast interstate highway. Therefore, how effectively the innovative clean coal technology arsenal is nurtured and focused will directly guide a large fraction of our Nation's capital investment and have a major impact on our competitiveness in a global market as the United States enters a new century.

Given these realities, it is, in my judgment, essential to remember that innovative clean coal technology is, first and foremost, a strategic capability to protect our national economy by eliminating the conflict between coal use and the environment.

I thank you all very much for your attention and look forward to questions.

[Testimony resumes on p. 500.]

[The prepared statement and attachments of Mr. Yeager follow:]

## STATEMENT OF KURT E. YEAGER

Mr. Chairman, Members of the Committee: I am Kurt E. Yeager, Vice President and Director of the Coal Combustion Systems Division of the Electric Power Research Institute (EPRI).

I appreciate this invitation to discuss Clean Coal Technology and its implications for electricity supply and environmental improvement. This program is especially significant for the electric utility industry, and therefore is of great importance to EPRI. EPRI was established by the electric utility industry in 1972 to conduct a broad research and development program for the entire electric utility industry and its ratepayers. EPRI'S R&D mission is to lead in the development of new and improved technologies for electric power production, delivery and use, and to help accelerate their availability insuring an economic, reliable and environmentally acceptable electricity supply.

Current environmental control capabilities must be improved by reducing capital and operating costs and preserving overall plant productivity. The importance of this effort is underscored by the fact that a new, large, conventional coal-fired power plant will typically cost $1.5 billion, with over 30% of this cost being directed toward environmental control. These controls in their current form also have a major impact on plant efficiency and reliability. Proposed additional emission control legislation would have even greater impact on existing power plants that today provide the generation equivalent of more than 150 such new plants. After many years of rising electricity costs and unresolved debate over environmental issues it is clear that we need technologies that use coal more cleanly and economically.

These goals must be pursued simultaneously. Our economic competitiveness in the global market depends on the continued availability of low-cost electricity from coal. And environmental improvements are sustainable in the long run only if they are part of an economically viable system. An intelligently planned and developed program in innovative clean coal technology can provide a win-win solution-one that responds to the environmental concerns of society, while keeping the cost of electricity low.

Since 1973, EPA reports that clean air programs nationwide have achieved a 27% reduction in $SO_2$ emissions while utility coal use increased 76%. EPRI analyses conclude that $SO_2$ emission will continue to decline under the existing Clean Air Act. Thus our growing understanding of the complex interaction among pollutants indicates that the nation should be concentrating on an effective, sustained strategy to continue the substantial progress already made while minimizing negative environmental and economic side-effects.

Especially important is application of new innovative clean coal utilization technology that better integrates emission control with the power generation process. EPRI and the electric utility industry have already spent more than a billion dollars and plan to spend at least two billion dollars more ushering clean coal technologies to commercial maturity. The approach is broad, encompassing improved methods of extracting impurities from coal before it is burned as well as innovative designs for new power plants that will produce fewer emissions, while improving the cost-effectiveness and productivity of coal utilization. Less costly retrofit emission control options are also being developed in the event that environmental science indicates the need for their application. Based on this initiative, we may ultimately witness the evolution of coal refineries capable of producing virtually no wastes and extracting chemical feedstocks, fuels, strategic metals, and other co-products from coal in addition to generating electricity.

My response to the four questions posed by the Subcommittee in its letter of invitation will endeavor to establish that:

1. Innovative clean coal technology is and will be productively used in the absence of additional emission control programs.
2. Innovative clean coal technology provides the opportunity to significantly reduce the cost and increase the environmental effectiveness of emission control programs.
3. The requirements and timing of emission control programs can discourage and even preclude the use of innovative clean coal technology.
4. The prompt and successful achievement of the advantages of innovative clean coal technology depend on (a) stable environmental policies that enhance productivity, as well as environmental protection, (b) effective risk-sharing programs to accelerate commercial maturity, and (c) avoidance of counterproductive compliance schedules.

My testimony today will build from the record established for this subcommittee on acid deposition risks during its May 28, 1988 hearings. Four points were emphasized:

- Damage to the environment is not as diverse or extensive as previously argued.
- Under present levels of emission and deposition, terrestrial and aquatic ecosystems are not in immediate danger.
- Society has time to complete decision making research on acidic deposition, as well as R&D on innovative clean coal technology that hold great promise for continuing the remarkable progress made in reducing emissions.
- We still cannot judge how effective a specific emissions reduction will be in protecting specific biosystems, or other resources.

These considerations are also reflected in the recommendations of the earlier "Joint Report of the Special U.S./Canadian Envoys on Acid Rain" (The Lewis/Davis report). First, environmental protection can best be achieved through use of innovative clean coal technology rather than ineffective, "band-aid" plant modifications that compromise both productivity and the environment. Second, accelerated commercial demonstration and implementation will require risk-sharing and the removal of regulatory disincentives. Third, continued research is required in the ecological and atmospheric sciences to better understand cause and effect relationships.

This change in approach provides an opportunity for a positive solution--one that builds on the electric utility industry's sustained commitment to technological improvements that can help resolve the environmental and economic challenges facing the nation. A national strategy which encourages the broadest and most productive use of innovative clean coal technology is not only the best way to sustain environmental progress but, in my judgment, the only practical way.

1. Innovative Clean Coal Technology Will be Productively Used Without Additional Emission Control Programs.

The principle which guides clean coal technology development and use by industry is that sustained environmental improvement is only possible when emission and cost reduction are achieved concurrently, not pitted against each other. Simply stated, "clean coal technology" is intended to reduce the policy conflict between coal use and the environment. It has evolved over the past decade into a family of precombustion, combustion, and post-combustion processes intended to provide the coal user with additional technical flexibility to resolve the conflict in an environmentally holistic manner, at the lowest possible cost. It is this goal which has caused the electric utility industry to lead the nation and the world in both developing and applying clean coal technology. The objective is not to eliminate other options, but to assure that the highly diversified energy market has an array of coal utilization and emission control options which together form the least cost solution.

The national benefits of applying innovative clean coal technologies include:

- Continued environmental improvement.
- Decreased cost of producing energy from coal.
- A cost cap on alternate fuels and imported energy.
- Improved international competitiveness of U.S. technology and coal.

In order to reduce the disadvantages facing conventional coal-fired power plants, clean coal technology development in the United States has pursued two primary objectives; viz., to

A. Provide improved coal utilization alternatives for both repowering and new plant applications. These combine high levels of emission and effluent control with reduced cost and improved productivity, and are thus best able to sustain the substantial progress already made in emissions reduction. Fluidized bed combustion and coal gasification are examples of technology addressing this objective.

B. Provide an array of retrofittable emission control options which satisfy, at reduced cost, the void between present physical coal cleaning capabilities and flue gas scrubbing for existing power plants. Examples include advanced coal cleaning, sorbent injection, and Low-$NO_x$ combustion. They are intended to complement and improve existing scrubbing and coal switching capabilities.

These objectives are geared to national, not just regional technology and economic opportunities. However, an important distinction should be recognized between these two objectives and the technology categories they represent. The first has the potential to reduce the absolute cost and increase the productivity of power generation. The second objective, on the other hand, limits the cost increase which would otherwise be imposed by more expensive retrofit controls.

Figure 1 indicates the general cost and performance envelope for these two clean coal technology objectives relative to commercially available options, specifically flue gas desulfurization and physical coal cleaning.

The foundation for the use of innovative clean coal technology is therefore, reduced cost. As this advantage is demonstrated, in terms of both performance and reliability, the coal user is aggressively adopting the results. Specific examples include:

- Fluidized Bed Combustions (FBC). Both industrial and electric utility applications are accelerating rapidly with over 5000 Mw of electric generating capacity now in operation, under construction, or on order. This includes both repowering and new plant applications, and represents the majority of coal-fired power generation capacity additions over the past three years. The basis for this acceptance in the demonstrated capability of FBC to reduce the cost of emission control while also reducing the cost of power production through increased fuel flexibility and modularity. As the envelope of confident FBC application is expanded through the DOE Innovative Clean Coal Technology (ICCT) Program, so will its use continue to accelerate through both atmospheric and pressurized designs.

- Advanced $SO_2$ flue gas control. Even though this class of clean coal technology (involving dry sorbent injection, spray drying, and advanced scrubbing processes) is still early in demonstration, results are nevertheless being commercially applied under situations where confident reliability, performance, and cost advantage have been established. This is particularly evident in lower sulfur coal plant applications to reduce the cost of compliance. Demonstrations proposed under the DOE ICCT Program will expand commercial use to the more demanding high sulfur coal arena.

- Low-$NO_x$ combustion modification. Low-$NO_x$ coal burner designs are being applied to both new and existing plants for those boiler types and operating conditions already successfully demonstrated. The basis for acceptance is the ability to suppress the formation of $NO_x$ while improving combustion performance and fuel utilization. As the performance and reliability of such combustion modifications are demonstrated under even more demanding conditions, their use will expand accordingly.

- Coal cleaning. Although the intensive physical removal of ash and pyritic sulfur from coal has been established in the steel industry, its broad application to utility steam coal is more recent. Again, acceptance has been based on site specific opportunities to reduce pollutants prior to combustion, reduce transportation costs, and improve plant reliability. As these advantages have been demonstrated, they in turn have spawned new process opportunities and commercial applications which accelerate both the breadth and depth of use. Chemical

> and even biological coal cleaning processes, in addition to advanced physical cleaning, are now proposed under the DOE ICCT Program and promise to further commercially expand this very important core clean coal technology category.

It is also instructive to consider the electric utility industry's commitment to Phase 2 of the DOE co-sponsored ICCT Demonstration Program, as illustrated in Table 1 and Figure 2. Of the 54 proposed demonstrations, 37 are directed to utility applications. These involve some 26 electric utilities providing nearly 70% of the nation's potentially affected coal-fired generating capacity. 17 categories of innovative clean coal technology are represented of which 12 are directed primarily to retrofit applications.

2. Innovative Clean Coal Technology Provides the Opportunity to Significantly Reduce the Cost and Increase the Environmental Effectiveness of Emission Control Programs.

The electric utility industry, which uses over 80% of U.S. coal production, stands at the threshold of fundamental change in its technological base for power generation. Historically, from the time of Thomas Edison's first coal-fired generating station in 1890 to the 1960's, the pace of coal technology advancement continued at a remarkable rate with the U.S. the world leader in both development and application. Over the past 20 years, however, further progress has stagnated in the face of new constraints including environmental and licensing requirements, declining coal quality and construction productivity, and escalating cost. Thus, it costs three times more today in the U.S. in constant dollars, to install a kilowatt of coal-fired generating capacity than in 1967, and even more than in 1920, for example.

Based on these changing realities, only a fundamental improvement in coal-fired power plant technology can effectively respond to the growing constraints on power generation and restore economic progress in electricity production. Innovative clean coal technology can help provide this improvement. Failure to meet this challenge will not only sacrifice environmental protection but will undermine national economic competitiveness, leading to further erosion of industry and jobs.

The urgency of these national goals is underscored by the challenge to future electricity supply capability. For example, the electricity generating capacity currently installed or assured of construction completion will only support an average growth rate in electricity demand of about one percent per year over the remainder of the century. By comparison, electricity demand over the turbulent past 13 years increased an average of 2.6% per year. Based on this experience we expect electricity demand to continue to pace the economy. Clean coal technology, if fully developed and applied, could significantly reduce the cost of electricity generation essential to the nation's economic prosperity. This cost reduction will rapidly increase with time as more new technology is applied and could reach $5 billion per year by the turn of the century, based on new plant and repowering applications. This is just the tip of the strategic cost-saving opportunity.

Although there are many types of innovative clean coal technologies, they typically have several characteristics in common which, in varying degrees, determine their generic cost-saving opportunities relative to existing technology:

- Better integration of emission control with the coal-based power generation process thus reducing complexity and the quantity of required equipment.
- Simplified process design characteristics leading to improved reliability and dependability, as well as construction modularity.
- Improved flexibility to target the wide range of site specific requirements associated with variability in coal type, plant design, and operating characteristics.
- Production of by-products which are more easily managed and potentially marketable.

The end result is an array of technical options tailored to the wide-ranging needs of the coal user and which collectively provide the lowest cost solution to the nation. The potential capital cost saving relative to existing technology ranges from 10% to 80%, and annual costs savings are typically 20% to 30% relative to coal utilization and emission control strategies which do not include the array of innovative clean coal technologies now in, or entering, demonstration.

These savings are perhaps best put in perspective by considering the magnitude of application. Over the next 20 years the United States will add at least 150,000 Mw of new coal-fired electricity generating capacity. This exceeds, for example, the total current generating capacity of Japan, Germany, or the United Kingdom. The savings to the nation which are achievable through the successful application of productive clean coal technology to this new capacity would exceed $60 billion in capital costs alone. In addition, the cost of proposed acid rain control legislation, requiring $SO_2$ and $NO_x$ control on over 150,000 Mw of existing coal-fired generating capacity, would typically be reduced by over one billion dollars per year.

The environmental and economic benefits to the U.S. of clean coal technology application versus immediate retrofit emission control are summarized in Figures 3 and 4. In Figure 3 for example, the area bounded by the solid curve and the dotted curve labelled CCT Plants, represents the probable $SO_2$ control impact of promptly deploying clean coal technology. This scenario can ultimately achieve and, most importantly, sustain a level of emission reduction exceeding that of typical retrofit emission control approaches. Just as the utility industry now controls emissions substantially beyond State Implementation Plan (SIP) requirements, so it is likely that the clean coal technology path for new and repowered plants will be followed on economic and productivity grounds as the technology is demonstrated to commercial maturity. The national goal should be to accelerate this desired path as efficiently as possible.

The impact of a retrofit 1.2 lb/MBtu $SO_2$ state-wide emission bubble is also indicated by the cross-hatched area. This provides only an initially larger $SO_2$ reduction peak which rapidly diminishes and converges with the New CTT Plant scenario. It also draws investment from more productive clean coal technology, and would tend to freeze existing control technology. Environmental science indicates that any emission control strategy which does not sustain its reduction well beyond that achievable through this retrofit approach is unlikely to demonstrate any real improvement in the environmental issues for which it is intended.

The comparative cost implications of these scenarios is described in Figure 4. The annual net cost savings associated with the CCT deployment scenario, relative to continuing current power plant design practice, grows continuously. On the other hand, the additional cash flow requirements associated with legislatively imposed retrofit emission control scenarios relying on conventional scrubbers and coal switching rapidly rise to a peak of as much as $10 billion/year in additional control costs. Such restrictive emission control legislation and its diversion of resources would act as a powerful deterent to the commercial application of emerging clean coal technology.

The key question which must be resolved before large scale application of these innovative clean coal technology options can occur is proof of their long-term reliability under utility operating conditions. It is therefore essential to stress the development and demonstration of these options at sufficiently large scale to verify their commercial reliability. Figure 5 indicates the characteristic learning curve associated with the development and commercial deployment of new technology. Today, the various innovative clean coal technology options under consideration have reached, or are approaching, first commercial demonstration. It is this "commercial demonstration" step where the size and cost of the facility necessary to assure reliable operation is the greatest. As the learning curve continues, each succeeding installation entails less risk and therefore less engineering margin and redundancy until full commercial maturity is reached. It is recognition of the risks inherent in this learning curve, and the need to share in the cost of their resolution, which defines the need for the Innovative Clean Coal Technology Initiative.

A case study of the much greater cost of ignoring commercialization risk is the forced deployment of flue gas desulfurization (FGD) scrubber technology in the U.S. This resulted in an exceptional history of cost and inefficiency. Contrary to sound development practice, FGD scrubber technology bypassed the scale-up process of development and was prematurely deployed at commercial scale as a result of legislative and regulatory requirements. The deployment process occurred in an adversarial atmosphere where the incentive was on least first cost without adequate understanding of, or insurance against, the performance and reliability risks involved. As a result, this "brute force" approach to development and deployment has involved over 50,000 MW of electric generating capacity at a total cost to the utility industry and rate payer of over $20 billion (1988 $) in capital, operating and lost generating capacity costs during the past 15 years. Only now is the technology approaching acceptable reliability, although at an excessive cost for operational risk protection and redundancy which still requires substantial development attention as reflected in proposals to Phase 2 of the DOE ICCT Demonstration Program.

Had FGD scrubber technology been developed and deployed in a more rational and cooperative manner, reflecting Figure 5, the cost could have been reduced to $1-2 billion involving no more than 2000 MW of capacity, with no delay in the time frame necessary to achieve maturity. In addition, the legacy of poorly performing or obsolete commercial scrubber installations and the resulting ill-will on the part of the user could have been avoided. One need look no further than the Japanese experience with emission control technology to see the contrasting success and cost/effectiveness of the more rational, cooperative approach to risk shared development and commercial maturation.

3. The Requirements and Timing of Emission Control Programs can Discourage and Even Preclude the Use of Innovative Clean Coal Technology.

Unfortunately, as indicated in the previous section, legislative and regulatory measures can and do restrict the use of clean coal technology by failing to provide the flexibility necessary to fully implement these opportunities. This can effectively limit electric utilities to either scrubbing or retiring the majority of their generating units. A requirement to apply current flue gas scrubbing technology to existing plants would typically impose an additional cost of about $300/Kw and would force many units into retirement at a time when their power generation capability will be increasingly important to the cost and reliability of electricity supply.

Several principles are therefore important in a control strategy intended to encourage the use of innovative clean coal technology.

- Sustain, as a primary national objective, the remarkable progress made over the past 15 year in emission reduction. This will encourage the most productive application of innovative clean coal technology for repowering and new plant application and minimize counterproductive "band-aid" control requirements.
- Reinforce a scientific basis for environmental quality goals and eliminate the continuing threat of administrative "racheting" of control regulations as a result of the technology forcing requirements of the Clean Air Act. This racheting risk tends to retard both the development and application of more effective technology because there is little incentive to invest in "better mousetraps" unless assurance is provided that a new technology can be nurtured without risk of regulatory violation or administratively imposed obsolescence.
- Achieve environmental quality goals with the least impact on cost and productivity. This principle will encourage innovative clean coal technology but more importantly will allow the market to choose the least cost solution among an array of control options. An effective strategy should be designed to ensure the availability of the necessary options rather than artificially restrict that market.
- Provide both schedule and risk sharing flexibility commensurate with the realistic commercial maturation and market potential of new technology. Today the range of innovative clean coal technology options are in or entering commercial demonstration. It is in this phase where the cost of facilities necessary to assure reliable operation is greatest. This "risk cost" then is reduced over a series of additional installations until full commercial maturity is achieved. The DOE co-sponsored Clean Coal Technology Demonstration Initiative is an essential step in accelerating this maturation process through risk-sharing.

- Establish a joint federal and state government commitment fostering clean coal technology as a prudent investment in the national interest, and remove governmentally imposed disincentives to their use. This is essential to the accelerated application of clean coal technology by the regulated electric utility industry. Specific recommendations in this regard have been developed by the President's Task Force on Regulatory Relief.

- Permit the broadest possible averaging of emission reductions consistent with the achievement of environmental quality goals. On a national basis, the actual cost savings achievable through a state-wide emission bubble versus, for example, a unit-by-unit emission cap for the same level of emission reduction can be as much as 50%. An important component of this savings is the expanded flexibility to utilize innovative clean coal technology.

- Recognize the cost-effectiveness sensitivity of increasing levels of emission control. This is particularly pronounced in the case of $NO_x$ control where the cost of innovative combustion modification is on the order of \$200 per ton of $NO_x$ controlled while post-combustion selective catalysis reduction technology can exceed \$2000 per ton of $NO_x$ controlled.

In summary, the prompt and successful achievement of the advantages of innovative clean coal technology will depend on (a) stable environmental policies that enhance productivity as well as environmental protection (b) effective risk-sharing programs accelerating commercial maturation and (c) avoidance of counterproductive compliance schedules.

- Complete the on-going DOE co-sponsored ICCT Demonstration Initiative as planned. In industry where reliability is paramount, complementary demonstrations which map the envelope of application, i.e., address the range of designs, fuels, suppliers, and operating variables faced by the user are required to achieve confident and cost-competitive commercial applications as quickly as possible for the broadest possible market.

Table 2 outlines the various advanced clean coal technologies and summarizes their major risk factors which must be resolved through the demonstration process.

Three primary factors determine the timing for a program intended resolve these risks and to achieve commercial maturity for the technologies involved.

a. The range of clean coal technologies involved.

b. The schedule for completion of prototype demonstration.

c. Commercial maturation requirements (number of units and required operating period).

The following summarizes our logic in addressing these questions. First, some 65 to 85 projects have been identified to achieve commercial maturity over the range of technologies, operating conditions, and risk factors outlined in Table 2. 19 of these are ongoing with a large fraction of the 54 demonstrations proposed under Phase 2 of the DOE co-sponsored ICCT Demonstration Initiative directly relevant to satisfying these requirements. EPRI, for example, is participating in about half of these proposed demonstrations. These required U.S. demonstrations represent only about 5% of the ultimate electric utility market and are consistent with similar national joint ventures underway by both Japan and West Germany to accelerate the commercial availability of advanced coal technology in their countries and abroad.

Assuming no further delays in the implementation of the DOE co-sponsored ICCT Demonstration Initiative, we would expect commercial maturity to be achieved in the time frame of 1994 through 2000, depending on the specific clean coal technology. At that point, the various technologies will have demonstrated their commercial potential across the envelope of application and are ready to compete on their economic merits in the marketplace. Full utilization will potentially involve a market of more than 150,000 Mw of existing coal capacity plus an additional 150,000 Mw of new and repowering capacity over the next 20 years. The sheer magnitude of that market must be carefully considered in terms of the additional time necessary to achieve commercial equilibrium, let alone saturation. These innovative clean coal technologies will directly guide a large fraction of the nation's capital investment and have a major impact on U.S. competitiveness in the global market.

Figure 1

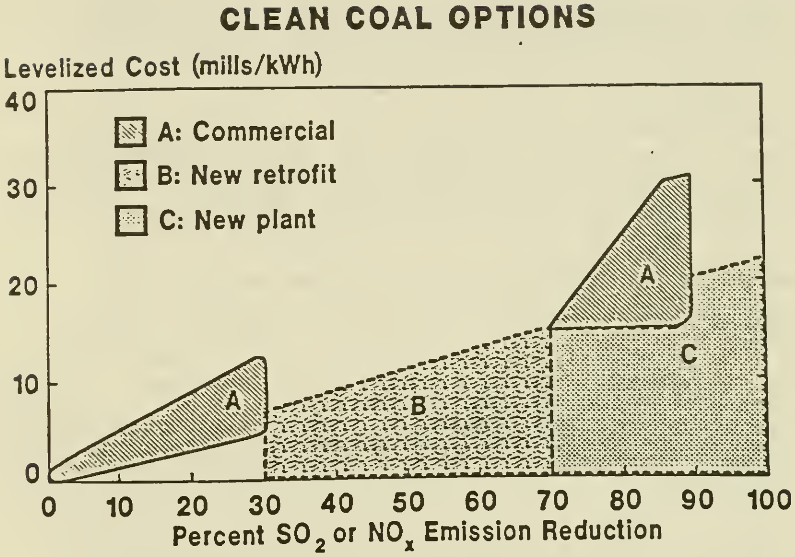

CLEAN COAL OPTIONS
Levelized Cost (mills/kWh)
40
30
20
10
0
A: Commercial
B: New retrofit
C: New plant
A
B
A
C
0
10
20
30
40
50
60
70
80
90
100
Percent $SO_2$ or $NO_x$ Emission Reduction

TABLE I

## ICCT-2 PROPOSAL SUMMARY

| Technology | Proposals | |
|---|---|---|
| Advanced physical coal cleaning | 4 | |
| Low rank coal upgrading | 4 | |
| Chemical coal cleaning | 1 | |
| Advanced conventional FGD | 2 | |
| Advanced regenerable FGD | 1 | |
| Furnace sorbent injection | 1 | |
| Duct sorbent injection | 2 | |
| Low $NO_X$ combustion | 5 | |
| Post combustion $NO_X$ control | 3 | |
| Combined $SO_2/NO_X$ control | 4 | |
| Slagging combustor | 1 | |
| AFBC | 10 | |
| PFBC | 2 | |
| Coal gasification | 5 | |
| Coal liquefaction | 1 | |
| Fuel cells | 1 | |
| Waste utilization | 1 | |
| Other industrial | 6 | 26 Utilities |
| | 54 | 37 Utility projects |

*EPRI cosponsorship or technical involvement

FIGURE 2

States*

| Technology | California | Florida | Georgia | Illinois | Indiana | Kentucky | Maine | Maryland | Minnesota | Missouri | Montana | Ohio | Pennsylvania | Texas | Virginia | West Virginia | Wisconsin | Wyoming |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Advanced Physical Coal Cleaning | | | | 44 | | | | | | | | | ▨ 43 | | | ▨ 40 | | |
| Low Rank Coal Cleaning | | | | | | | | | | | 13 | | | | | | | 26<br>52 |
| Chemical Coal Cleaning | | | | | | | | | | | | | | | | | | |
| Advanced Conventional FGD | | | ▨ 1 | | ▨ 25 | | | | | | | | | | | | | |
| Advanced Regenerable FGD | | | | | | | ▨ 17 | | | | | | | | | | | |
| Furnace Sorbent Injection | | | | | | | | | | | | ▨ 22* | | | | | | |
| Duct Sorbent Injection | | | | | | | | | | | | | 24 | | ▨ 6 | | | |
| Low NO$_x$ Combustion | | ▨ 4 | ▨ 2 | | | | | | | | | ▨ 20*<br>5 | | | | | ▨ 21 | |
| Post Combustion NO$_x$ Control | | ▨ 3 | | ▨ 32 | | | | | | | | ▨ 34 | | | | | | |
| Combined SO$_2$/NO$_x$ Control | | | | | | | | | | | | ▨ 11<br>9 | | | | | | |
| Slagging Combustor | | | | ▨ 41 | | | | | | | | | | | | | | |
| AFBC | | 51 | | ▨ 27<br>30 | | 28<br>31 | | | | ▨ 14 | | | 39 | 16 | | | 38 | |
| PFBC | | | | ▨ 37* | | | | | | | | | | | | 18 | | |
| Coal Gasification | ▨ 53 | ▨ 8 | | 33 | | | | | | | | 15 | | | | | | |
| Coal Liquefaction | | | | | | | | | | | | 10 | | | | | | |
| Fuel Cells | | | | ▨ 35 | | | | | | | | | | | | | | |
| Waste Utilization | | | | | | | | | ▨ 48 | | | | | | | | | |
| Other Industrial | | | | 47<br>50 | | | | 19 | | | | 12 | 36 | | 23 | | | |

Proposal Number(s)

▨ EPRI cosponsorship or technical involvement.

* Missing some location information.

Figure 3

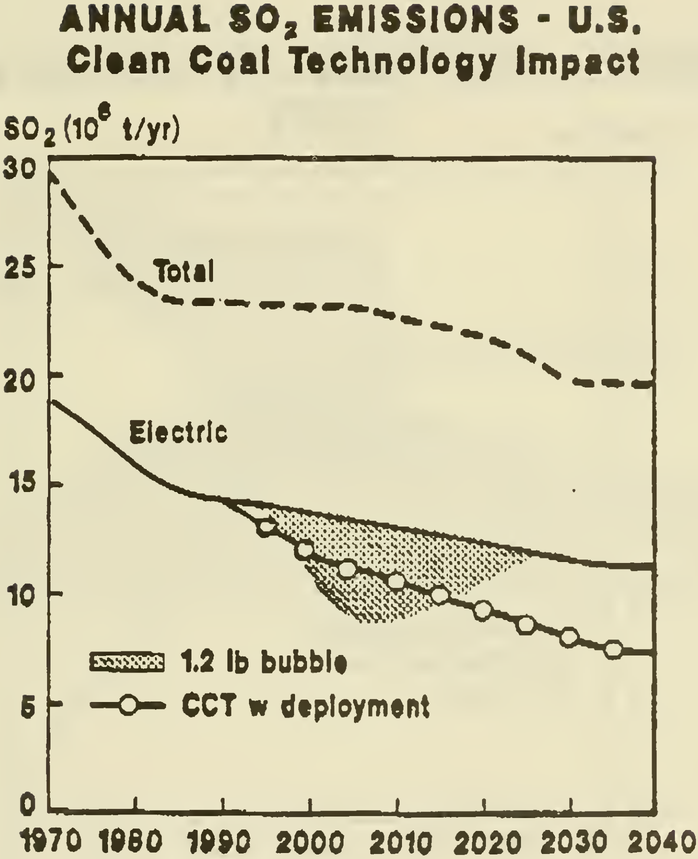

ANNUAL $SO_2$ EMISSIONS - U.S.
Clean Coal Technology Impact
$SO_2$ ($10^6$ t/yr)
30
25
20
15
10
5
0
Total
Electric
1.2 lb bubble
CCT w deployment
1970
1980
1990
2000
2010
2020
2030
2040

FIGURE 4

ANNUAL UTILITY EMISSION CONTROL COST (1986$)

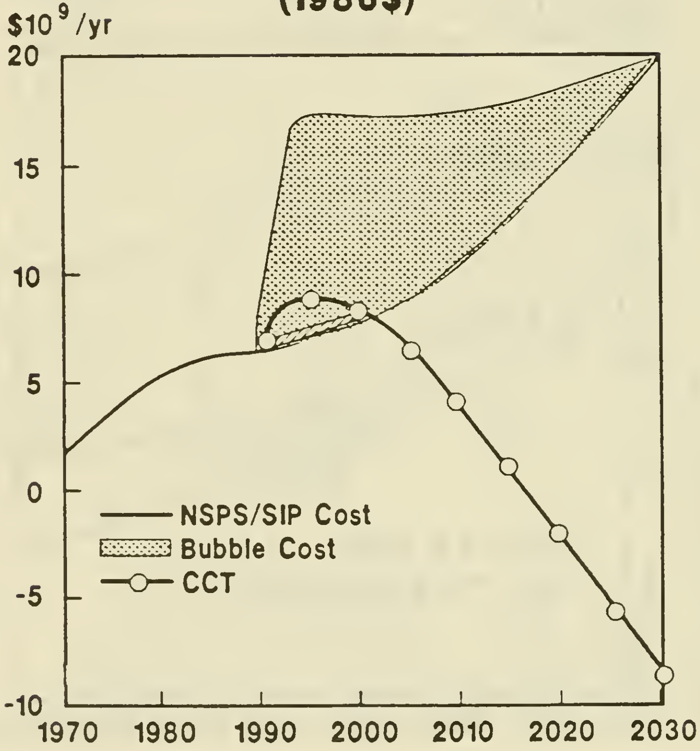


FIGURE 5

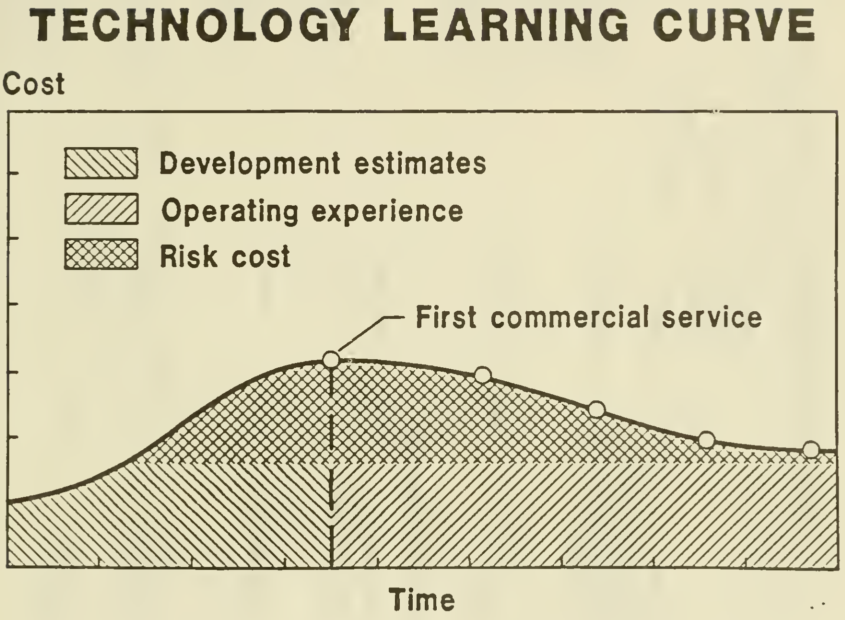

TECHNOLOGY LEARNING CURVE
Cost
Development estimates
Operating experience
Risk cost
First commercial service
Time

TABLE II

## CLEAN COAL TECHNOLOGY APPLICATONS AND RISKS

| Technology | Capital Cost ($/kW)[1] | Net Cost Effectiveness ($/Ton $SO_2$ OR $NO_x$ Removed) | Application | | Risk Factors |
|---|---|---|---|---|---|
| | | | Retrofit | Repower/ New | |
| 1. COAL CLEANING AND UPGRADING | | | | | |
| a. Advanced Physical' Coal Cleaning | 60-100 | 400-600 | X | X | • Degree of sulfur removal<br>• Btu recovery<br>• Increase in coal moisture<br>• Economic agglomeration technology |
| b. Low-Rank Coal Upgrading | 10-60 | 300-800 | X | X | • Capital cost of equipment<br>• Btu recovery<br>• Product quality<br>• Increase in coal moisture |
| 2. WET FLUE GAS DESULFURIZATION | | | | | |
| a. Conventional FGD | 400-450 | 825-1200 | | | |
| b. Advanced Conventional FGD | 250-275 | 450-650 | X | X | • Capital costs of redundancy and materials<br>• O&M cost savings through elimination of reheat |
| c. Advanced Regenerable FGD | 550-650 | 650-850 | X | X | • Capital costs of materials and redundancy<br>• O&M costs associated with membrane plugging, sorbent use |
| 3. DRY $SO_2$ CONTROL | | | | | |
| a. Furnace Sorbent Injection | 50-75 | 800-1000 | X | | • Boiler impacts<br>• ESP upgrade costs<br>• Waste management |
| b. Duct Sorbent Injection | 50-100 | 500-1000 | X | | • Duct deposition (calcium systems)<br>• Baghouse performance (hybrid system)<br>• Soluble wastes, $NO_2$ plume, sorbent cost and availability (sodium system)<br>• Particulate control/humidification<br>• Waste management |

| Technology | Capital Cost (\$/kW)[1] | Net Cost Effectiveness (\$/Ton $SO_2$ OR $NO_x$ Removed) | Application | | Risk Factors |
|---|---|---|---|---|---|
| | | | Retrofit | Repower/ New | |
| 4. $NO_x$ CONTROL | | | | | |
| a. Combustion Modification | 5-35 | 100-1000 | X | X | • Effects on carbon burnout, flame stability, slagging and corrosion |
| b. Post-Combustion $NO_x$ Control | 75-100 | 1000-4000 | X | X | • O&M costs of catalyst replacement<br>• Availability loss due to air heater cleaning |
| 5. FLUIDIZED BED COMBUSTION | | | | | |
| a. Atmospheric | 300-1600[2] | 200-500[3] | X | X | • Capital and O&M costs of heat transfer surface and solids handling systems |
| b. Pressurized | 800-1500[2] | 200-450[3] | | X | • Capital costs as per AFBC<br>• O&M costs of sorbent utilization and gas turbine maintenance |
| 6. INTEGRATED GASIFICATION COMBINED-CYCLE | 1300-1900[2] | 200-400[3] | | X | • Capital costs of design conservatism<br>• O&M costs of heat transfer fouling, refractory & sulfur recovery<br>• Availability loss during startup |

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[1] For an approximately 250-MW retrofit/repower unit to burn medium- to high-sulfur coal (2.5-4% sulfur). In 1986 dollars.

[2] Total installation cost range reflects repower and new applications.

[3] Net $SO_2/NO_x$ control cost effectiveness based on fraction of total capital and operating costs assigned to emission control.

Mr. SHARP. Thank you very much, Mr. Yeager.

We now welcome Mr. Disbrow from American Electric Power.

## STATEMENT OF R.E. DISBROW

Mr. DISBROW. Thank you, Mr. Chairman and members of the subcommittee, Congressman Regula.

I am appearing today as chairman of the Clean Coal Technology Coalition, an ad hoc organization whose 73 members include electric utilities, coal companies, architect and engineering firms, equipment manufacturers, several State governments and universities, the Edison Electric Institute, the National Coal Association, and the United Mineworkers of America.

At the outset, I wish to note for the record, as several have done before me, that $SO_2$ emissions are trending downward. The scientific evidence to date, including that compiled by NAPAP and the conclusions apparently reached by the panel of noted scientists who appeared before you last May 26, indicate that we are not facing an environmental crisis or catastrophe. We have the time for thoughtful consideration and sensible cost-effective action like that currently being undertaken through the Clean Coal Program.

Our coalition has previously testified before this subcommittee and reiterates again our belief that enactment of acid rain control legislation will frustrate the development of these newer technologies. Why? Because utilities faced with stringent new emission reduction requirements will rely on the proven and not immature clean coal technologies. Concentration of our limited resources on compliance with the tried and proven will force abandonments of projects such as the 330 megawatt pressurized fluidized bed project we recently proposed to DOE under the second clean coal technology solicitation. We simply cannot do both.

I would like to make three further points in response to questions which you previously posed to me, Mr. Chairman, and a more detailed discussion is set forth in my written statement which will be submitted for the record.

First, contrary to the arguments of some that enactment of acid rain control legislation will accelerate development of clean coal technologies, as I stated a moment ago, I believe, in fact, it would serve to stifle such development. Technological development cannot be accelerated beyond a point. With the assistance of the Federal co-funding program, it is now on the fastest track.

Additionally, those technologies to be used in repowering of existing facilities or in the new Greenfield plants and offering the most promise of more cost-effective power production in an environmentally superior manner will be brought to the marketplace, in any event, as quickly as commercially available.

So-called retrofit technologies to be used solely for emission reductions will not be introduced as rapidly unless needed to meet local environmental requirements. However, two-thirds of the response to the recent DOE solicitation related to retrofit technology. This heavy weighting shows clear interest in developing an insurance policy by expanding the menu of technology options should ongoing scientific research lead to the conclusion in the future that emission reductions are required.

Second, you have asked, Mr. Chairman, for our assessment of the minimum requirements of an acid rain control program to preserve clean coal technologies as a possible compliance option if acid rain control legislation is indeed enacted. I believe three things are mandatory: One, a sufficient amount of time must be allowed to permit clean coal technology demonstration, deployment, and market penetration to occur; second, continued funding of a clean coal technology deployment program is essential in bringing these technologies to the earliest commercial maturity and therefore readiness for widespread usage; and, third, adoption of regulatory incentives and the elimination of disincentives to assure cost recovery for those utilities that pioneer these new technologies.

There is the added need to protect such pioneering use against any subsequent changes in environmental regulations that might thereafter render a clean coal technology useless because it is unable to comply with the new requirements.

In answer to your final question regarding how utility managers go about determining how to comply with an acid rain control program, I feel the compliance strategies will vary utility by utility. The only generalization I can offer is that the decisions will be made on the basis of life cycle costs of the various compliance options which, in turn, will be influenced by the available menu of commercial cost-effective technologies in relation to other options such as fuel switching.

I appreciate the opportunity to appear before you, and I will be pleased to try to respond to any questions.

[Testimony resumes on p. 517.]

[The prepared statement and attachment of Mr. Disbrow follow:]

### WRITTEN STATEMENT OF
### R.E. DISBROW
### PRESIDENT AND CHIEF OPERATING OFFICER
### AMERICAN ELECTRIC POWER SERVICE CORP.

This written statement is submitted by R.E. Disbrow, President and Chief Operating Officer of American Electric Power Service Corporation, on behalf of the Clean Coal Technology Coalition.

The Coalition is an ad hoc group of electric utilities, equipment suppliers, coal companies, architect-engineering and construction firms, several state governments and universities, the National Coal Association, the Edison Electric Institute and the United Mine Workers of America. The Clean Coal Technology Coalition, which has a total membership of 73 organizations, was organized in early 1985 for the specific purpose of encouraging the demonstration, deployment and widespread use of clean coal technologies.

In prior appearances before this Subcommittee and other committees of the Congress the Coalition has testified that enactment of acid rain control legislation like that introduced by Messrs. Waxman and Sikorski and pending in the House Energy and Commerce Committee, or like that reported by the Environment and Public Works Committee and pending before the Senate, would impede or discourage further development of promising clean coal technologies. Further, any legislation to impose additional emission reduction requirements, that are judged by many to be unnecessary, will impede progress in the accelerated development of emerging clean coal technologies.

It should not be forgotten that SO2 emissions are trending downward, meaning that the Clean Air Act is functioning properly. Also, the findings of NAPAP (the National Acid Precipitations Assessment Program) to date confirm that there is no scientific evidence that emissions resulting from the use of coal are causing damage to forests, crops or aquatic sources. The scientific research of NAPAP, which has been federally authorized and funded, will be completed by the end of 1990. Information provided to this subcommittee on May 26, 1988, in which a distinguished group of scientists testified about the existing state of knowledge concerning acid deposition and its impacts, verified that this nation is not facing an environmental catastrophe. We have the time for thoughtful consideration and sensible, cost-effective action like that currently being undertaken through the clean coal program.

In his letter of invitation to testify, Chairman Sharp set forth a series of questions that are to be addressed. In this statement answers have been provided to the Chairman's questions by discussing the following issues:

1. Clean coal technologies will be developed and used without the adoption of additional environmental control requirements.

2. If Congress adopts an acid rain control program, clean coal technology development will be discouraged or delayed depending upon the requirements of such a control program.

3. Clean coal technologies will be utilized in complying with an acid rain control program only if such technologies already have been proven reliable and cost effective in comparison with other compliance options.

## II. CLEAN COAL TECHNOLOGIES WILL BE USED ABSENT ACID RAIN CONTROL LEGISLATION:

### A. Projected Market for Coal to Meet Electricity Demand

Coal is our nation's most abundant domestic fossil fuel resource (coal represents about 80 percent of U.S. fossil fuel reserves) and currently supplies the fuel for more than one-half of the electricity generated in this country. Our projections of modest overall growth, set forth in the table below, indicate that the role of coal in the future generation of electricity will increase steadily.

Table I
RANGE OF U.S. ELECTRIC GENERATING CAPACITY
(GIGAWATTS)

| YEAR | ALL SOURCES | COAL | % COAL |
|---|---|---|---|
| 1985 | 588 | 288 | 49.0 |
| 1995 | 620-625 | 315-320 | 51.0 |
| 2005 | 700-720 | 385-405 | 56.0 |
| 2020 | 840-890 | 520-575 | 63.0 |

| ASSUMPTIONS: | PERCENT CAPACITY GROWTH | |
|---|---|---|
| | ALL SOURCES | COAL |
| 1985-1990 | 1.0-1.2 | 1.8-2.0 |
| 1990-1995 | 0* | 0* |
| 1995-2020 | 1.2-1.4 | 2.0-2.4 |

*Based on 1985-86 projections, existing capacity would be operating at higher capacity factors and thus demand would be met by this means.

As shown in table I, by the year 2020, between 250,000 and 300,000 megawatts of additional capacity may be required to meet steadily-increasing demand.[1] Satisfying even modest growth in electricity, the nation will require more than 100,000 megawatts of additional new capacity during the remainder of this century. Much of the additional requirements will depend upon coal.

## B. New Cost Effective Electric Generation and Environmental Controls are Needed to Meet Increased Demand

The utility industry is faced with two realities about the technologies currently available to use coal and to control air emissions from the use of coal.

First, conventional pulverized coal units are the only available technology commercially proven for the generation of large amounts of electricity from coal. Because pulverized coal units depend upon economies of scale, they are relatively large units requiring long construction periods and large capital investments. This technology is near the end of its development potential.

Second, the utility industry has available only three conventional options to control SO2 emissions from coal use -- coal cleaning, conventional scrubbers, and coal switching.

Each of these methods for controlling coal-derived air pollutants has disadvantages. For example, conventional coal cleaning has only a limited ability to remove sulfur, typically only 10 to 30 percent of the total sulfur in coal. Conventional scrubbers are very costly and can only be retrofitted to an existing unit if sufficient space at the powerplant site is available. In addition, conventional scrubbers use a portion of the electricity produced in the powerplant to operate, thus lowering efficiency. Also, the typical flue gas desulfurization system today produces a wet waste product that causes its own environmental impact. Coal switching could become costly if a significant shift to low sulfur coal occurs and the demand for such coal exceeds the supply. Use of lower sulfur coal in units originally designed for higher sulfur coals can also result in boiler derating which lowers power output, due to coal characteristics which do not meet or are in conflict with the design specifications of a particular boiler. Also, unless designed for low sulfur coal use, the operation of electrostatic precipitators could be adversely affected and such coal use could create problems of particulate compliance. The limitations of these current means to control air pollutants are aggravated by the wide diversity of the nation's utility boiler population in terms of boiler designs, ages, sizes and configurations, as well as the type of coal consumed.

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[1] According to composite data compiled from other sources, including the Department of Energy, the Electric Power Research Institute, Energy Information Associates and the Utility Data Institute, over 100,000 megawatts of existing coal-fired capacity will likely be replaced between the years 2000 and 2020, and approximately 250,000 megawatts of additional capacity will have to be added between now and 2020.

In the face of these realities, the electric utility industry must change its technological base for electricity generation derived from coal. New power generation options are required which can meet increasingly-stringent siting and environmental standards without sacrificing productivity; which can be rapidly constructed in modular fashion while retaining acceptable economies over a wide range of unit sizes to better match uncertain demand growth; and, which are less sensitive to fuel type and quality in a single design. Most important, increased coal utilization must be made compatible with environmental protection. This means that emissions reduction and cost-effective electricity generation must be achieved concurrently and not pitted one against the other. Clean coal technologies are the key to that compatibility. Successful development and use of emerging clean coal technologies can provide a win for ratepayers by moderating inceases in electric rates and a win for the environment.

Among the many potential technical and cost advantages of clean coal technologies are the following:[2]

- reduction of sulfur dioxide (SO2) emissions in a more cost effective manner than currently-available technology;
- simultaneous reduction in some cases of both SO2 and NOx emissions (scrubbers only reduce SO2 emissions);
- attainment of required environmental control at lower capital and operating and maintenance costs than current technology;
- utilization of a wide range of low-cost, locally-available coals, including high sulfur and low sulfur eastern coals and low sulfur western coals;

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[2] A further description of the cost and technical advantages of clean coal technologies compared to conventional control options -- as requested by Chairman Sharp in question #3 of his letter of invitation to testify -- is attached to this written statement as an appendix.

- modularity in some cases, which means units can be sized more closely to match load growth and can take advantage of the economies of shop assembly and pre-fabrication, thereby shortening construction time and cost;
- cost savings of 10 to 20 percent depending upon plant size for new applications when compared to conventional generation technology;
- use of existing plants and plant sites in retrofit and repowering applications, thereby avoiding premature plant retirements or replacement with other fuels; and,
- projected savings of 10 to 30 percent over conventional technologies when retrofitting existing facilities with clean coal retrofit technologies and, if scientific evidence determines the need for emission reductions at older plants then these retrofit technologies would provide attractive economic means by which to achieve reductions.

Furthermore, success in the development of these technologies may preserve American mining jobs in the high sulfur coal fields, will better ensure U.S. industrial competitiveness, and could expand the trade of American coal and technological know-how (without substantial efforts to encourage accelerated development, these technologies will be imported for use and the U.S. will lose its current lead in this field of technology development).

### C. Clean Coal Technologies will be Developed Without the Imposition of Additional Air Quality Regulations

Additinal air quality regulation is not the reason why industry will develop clean coal technologies, although some argue that the imposition of additional regulation might drive industry to develop and use clean coal technologies. Indeed, as will be explained in detail later in this statement, such increased regulation as currently being proposed by some in Congress will likely discourage or impede the development of clean coal technologies rather than encourage that development.

The need to produce competitively-priced electricity from coal and also meet existing environmental requirements in an ever-expanding market for electricity are the reasons for the current development and future use of these technologies. The utility industry, long ago, recognized that new means of power generation and environmental control technology are necessary if we are to maintain and increase the use of coal. American Electric Power, for example, began development of pressurized fluid bed technology in 1976, long before the current clean coal program was initiated and before additional air emissions control requirements became an issue. Others in the industry have followed a similar path.

Information to date strongly suggests that those clean coal technologies intended to repower existing facilities or to be applied in new, "greenfield" applications will make the use of coal more cost competitive and environmentally acceptable. Thus, given the projections for increased coal use, it can be easily concluded that technologies designed for repowering or new applications will be developed and used in the absence of additional environmental regulations. Such a conclusion may not follow with respect to so-called retrofit technologies that are designed to reduce emissions only and, unlike repowering or new clean coal technologies, do not also involve the more efficient production of electricity. This lack of a market-oriented rationale for development may be especially true of those retrofit technologies that are not able to achieve levels of SO2 emissions reduction that will meet current new source performance standards (that is, 90 percent reductions).

With respect to retrofit technologies, however, it should be noted that two thirds of those demonstration project proposals submitted to the Department of Energy pursuant to the on-going clean coal solicitation were projects involving retrofit technologies. Further, if successfully developed, some of these retrofit technologies will be adequate, either directly or in combination with one another, to achieve local environmental requirements. Finally, if on-going scientific inquiry concludes the need for additional emissions reductions, and Congress so determines, then the successful development of retrofit technologies will have been highly desirable. In this way, the current development and demonstration of retrofit technologies are an insurance policy against the cost impacts of additional controls.

### D. Timeframe in which Clean Coal Technologies will be Developed

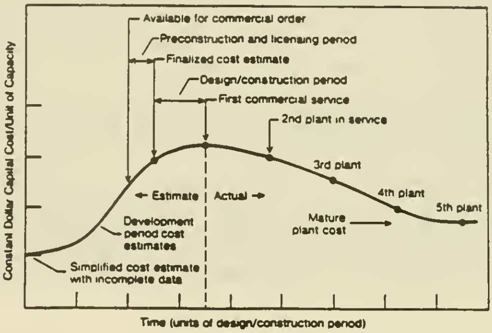
In the absence of programs designed to specifically assist in the accelerated development of new technologies, it can be expected that clean coal technologies will require very significant periods of time in which to be demonstrated, deployed and finally utilized. This is so because of the substantial risks associated with any new technology and it is particularly acute in the electric utility sector which requires a high level of plant reliability and which depends upon regulatory approval to recover the costs of utility investment.

The private sector, acting alone, cannot afford the financial burden and financial risks of new technology development. By sharing in the costs and financial risks of a first-of-a-kind commercial demonstration project, the government can greatly facilitate that development. Thus, the most important initiative undertaken by government to date to accelerate the introduction of these technologies into the marketplace is the on-going Department of Energy clean coal program.

To further accelerate the commercialization of these technologies, the Coalition supports a multi-year clean coal technology deployment program which would allow the government to cost-share the construction and operation of several additional demonstrations utilizing the same or similar technologies at various sites and applications. President Reagan, to fulfill this country's commitment to Canada to implement and fully fund a five year, five billion dollar clean coal demonstration program, has requested an additional $1.775 billion for fiscal years 1990-1992 to implement this expanded demonstration program. Legislation introduced by Senator Robert Byrd (S. 879) and Representative Kenneth Gray (H.R. 1995) also envisions a multi-year and multi-billion dollar national program. There is disagreement or, at least, confusion over the goals and objectives to be achieved from the greater amounts of funds being sought by the President and proposed in legislation. Specifically, many question the need to support multiple projects (at what would be considered utility scale) of the same or similar technology, under different and real world utility operating conditions.

The objective of supporting multiple plant applications is to refine the technology so that the capital and operating costs of subsequent plants can be minimized. Multiple plant demonstrations also offer the benefit of spreading among potential users the "hands on" technology experience so critical to the pace of market penetration to be achieved by a given technology. In the course of technology development, it is well accepted that the first commercial project using a new technology will cost more than that project which represents a subsequent mature technology. This developmental process can be depicted by the following chart:

COST LEARNING CURVE



Support of projects to achieve maturation of a generic technology does not mean the support of identical projects. Different coals, different suppliers, different equipment configurations and different applications of the same or similar technology should be sought. The goal of such a development program would be to demonstrate technical feasibility, economic competitiveness and the existence of a qualified supplier or suppliers of the technology who are able to warrant the performance of that technology to the exacting standards of the utility industry.

If such an accelerated clean coal demonstration program were supported by industry and the federal government, we believe the dates by which various technologies might be available for commercial order would be as depicted in the following chart:

Range of Estimated Commercial Availability
Dates of Clean Coal Technologies
(assumes implementation of a clean coal deployment program)

| Technology Class | Potentially Available for Commercial Order* (Range of Estimates) | Potential Widespread Commercial Use to Achieve Reductions of Air Pollutants** |
|---|---|---|
| Advanced Physical Coal Cleaning | 1994-1996 | Post 2000-2005 |
| Chemical Coal Cleaning | 1998-2000 | Post 2010-2015 |
| Low Grade Coal Upgrading | 1993-1995 | End 1990's-2000 |
| Advanced & Regenerable FGD | 1995-1998 | Post 2005-2010 |
| Furnace Sorbent Injection | 1993-1995 | Post 2000-2005 |
| Duct Sorbent Injection | 1994-1996 | Post 2000-2005 |
| NOx Control During Combustion | 1996-1998 | Post 2005-2010 |
| NOx Control Post Combustion | 1996-1998 | Post 2005-2010 |
| Integrated Gasification Combined Cycle | 1996-1998 | Post 2005-2010 |
| Utility-Scale Atmospheric Fluidized Bed | 1994-1996 | Post 2000-2005 |
| Pressurized Fluidized Bed | 1998-2000 | Post 2005-2010 |

*Assumes that the ongoing clean coal technology demonstration program continues; that a deployment program providing for several subsequent commercial-scale demonstrations of the same or similar technology will be fully implemented (number of deployment projects will vary by technology); that neither the demonstration nor deployment projects will fail; and, that deployment projects of the same generic technology will be initiated roughly in parallel and not in sequence to accelerate further the development schedule, (through the sequential approach would save dollars and permit maximum learning value from the prior projects). A successful deployment program is intended to provide sufficient operating experience with a given technology to establish technical feasibility, economic competitiveness with other commercially-available options, and qualified suppliers capable of guaranteeing the technology's performance.

**Assumes that industry will not be precluded from using the technology once it has been successfully demonstrated and deployed. To make a significant contribution to the reduction of atmospheric pollutants, the clean coal technologies must penetrate the market. Depending upon the degree of difficulty, size and complexity of each clean coal project or application, each commercial clean coal project will require 2 to 3 years from start date to placed-in-service date for simple engineering modifications and 5 to 7 years for projects requiring major equipment installation. Initially, to minimize risk, a utility will apply a retrofit or repowering technology to one or two units and not to the entire system. Once that utility gains experience and confidence in the technology it will likely be applied to other units in that utility's system. Each utility is likely to proceed in this same manner depending upon its individual, and unique, circumstances. Further, utilities will not all proceed to use such technologies at the same time. Therefore, significant market penetration which, in turn, will likely yield a significant contribution to the reduction of air pollutants, will take time and a decade beyond the date of commercial readiness is not an unreasonable estimate. Forcing use of the technologies through requirements for early reductions will only lead to abandonment of the newer technologies in favor of currently available technology, for example, wet-limestone scrubbers.

In order to achieve significant reductions in air pollutants by application or use of these various clean coal technologies, as much as a decade or more would be required once the technology is available for commercial order.

## E. Barriers to the Adoption of Clean Coal Technologies and Some Suggested Recommendations to Eliminate Those Barriers

Even if the Congress agrees to provide expanded funding to the clean coal program as requested by the President, it should be understood that barriers still exist to both the expanded demonstration of clean coal technologies and the eventual widespread use of those technologies. Two of the most significant of these barriers are the uncertainty of cost recovery for the investment made in a clean coal project and the exposure of the utility to non-compliance with environmental regulations should the technology not achieve certain prescribed standards.

Typically, utility managers must satisfactorily answer the following questions before investing in clean coal technology:

- Will the technology work in commercial scale applications?
- Will the technology be sufficiently reliable that management may count on the plant being available to meet service obligations to customers?
- Will the investment be recoverable?
- Will the investment on the first several units of a new technology be recoverable where those initial units or alternatives to use of coal are likely to be higher in cost than subsequent units?
- Are there affirmative reasons (for example, greater efficiency, reliability, environmental performance) to justify the time and money required for project development?
- Will changes in environmental regulation render the investment wasted and further jeopardize its recovery?

Questions of technical feasibility, reliability of the technology at commercial scale, and economic and environmental performance can be answered with a properly-focused and successful demonstration and deployment program. But, cost recovery and changes in environmental regulation bear special mention because additional assistance may be needed to overcome these barriers to investment.

Major financial risk is associated with development of a clean coal technology that must satisfy the economic and reliability parameters for electric utility appliction. Disincentives to investment, including retrospective prudence reviews by regulatory commissions, have resulted in utility management deciding to delay commitments to new baseload plants and to even more risky new technologies. These disincentives to investment are one reason why essentially no commitments to new baseload capacity have been made over the last several years and very little additional capacity, except for PURPA-type qualifying facilities and low capital cost natural gas-fired combustion turbines, is planned for commitment over the next several years. This same aversion to the risks associated with investment in new baseload capacity applies to clean coal technologies with even greater force.

Under the current regulatory climate, technologies that do not perform as anticipated may be subject to penalty by regulatory agencies that govern the rates charged by utilities. Furthermore, cost recovery of retrofit technologies that do not achieve NSPS levels of performance may be jeopardized if emission requirements, imposed subsequent to the installation of the retrofit technology, require major additional commitments of capital. These serve to discourage the technological risk-taking that is necessary for new technology to achieve greater reliability and lower costs. So long as regulatory actions threaten to place the majority of risk on the shareholder without commensurate payback potential for the degree of risk taken, there will be a reluctance to embark upon development of large-scale, capital-intensive new technologies. Regulatory mechanisms to be applied at the federal and state regulatory level, like those proposed in S. 879 and H.R. 1995, should be considered in order to best assure the possibility of recovery of investment and to balance regulatory oversight with encouragement of technological development.

During the demonstration stage, and even in the absence of additional emission reduction requirements which would be mandated by passage of proposed acid rain control legislation, utilities are still vulnerable to the unyielding requirements of current environmental regulations. For example, if a technology is not able to attain projected emission reductions by a certain date, environmental requirements may be imposed on the source and the utility required to achieve emission reductions through other means. As a result, an investment in a clean coal technology could be lost.

Also, an expenditure today for a retrofit technology that achieves significant reductions but does not achieve current NSPS levels could be lost if an acid raid control proposal were enacted which required higher emission reductions from the unit previously retrofitted with a clean coal technology. The means to protect the owner or operator of a facility that takes the risk of developing a clean coal technology from subsequent changes in environmental law or regulations should be found.

Changes to existing environmental regulations like those proposed by the President's Task Force on Regulatory Relief should also be encouraged. And finally, it must be recognized that compliance with environmental regulations is a complex and time consuming process; some procedural mechanism that would facilitate decision-making and answer questions for clean coal technology developers about options to comply with environmental regulations might be very helpful and better assure industry interest.

## II. ENACTMENT OF CURRENTLY PENDING ACID RAIN CONTROL LEGISLATION WILL IMPEDE OR PROHIBIT CLEAN COAL TECHNOLOGY DEVELOPMENT:

### A. Enactment of the Mitchell bill (S. 1894) or the Waxman-Sikorski bill (H.R. 2666) Would Discourage Development of Clean Coal Technologies

Enactment of an acid rain control measure which requires significant reductions of air pollutants from coal use in the 1990's will discourage the demonstration and maturation of new clean coal technologies. The development of technologies simply takes time. Under ideal circumstances -- given a fully-financed deployment program, without new emission control requirements -- industry will still require much of the 1990's to demonstrate, deploy and bring to commercial maturity clean coal technologies. Thus, even if a significant program of federal financial incentives were enacted to accompany a control program it is doubtful that industry would use limited resources to cost-share in the demonstration of risky technologies when faced contemporaneously with requirements for massive emission reductions. A utility will comply with such requirements by switching fuel sources, shutting down powerplants prematurely or retrofitting conventional scrubbers; emerging clean coal technologies will be a very limited option.

AEP recently proposed to the Department of Energy to cost share the development, construction and operation of a 330 megawatt, full commercial-sized pressurized fluidized bed repowering project at our Philip Sporn plant. The project is estimated to cost $579.3 million of which the DOE has been asked to contribute $184.8 million. If acid rain control legislation, like that pending before the House Energy and Commerce Committee or the U.S. Senate, were enacted, this clean coal project would have to be abandoned and our resources used to comply with these new environmental requirements by use of currently-available options.

### B. Clean Coal Technology Development would be Impeded Under Any Acid Rain Control Program

Any acid rain control program will impede the development and use of clean coal technologies. This is so because a requirement to reduce emissions will always drive regulated utilities affected by such requirements to those methods of compliance which are commercially tested and available even if potentially less expensive, more efficient but not thoroughly proven alternatives are also available. As previously discussed in this statement, clean coal technologies, even where supported by additional federal financial and regulatory incentives, along with favorable state regulatory treatment of clean coal projects, will not be ready for commercial use until the late 1990's and, realistically, widespread use will probably not occur until after the turn of the century.

Alternatively, if reductions in emissions are not required before the turn of the century then it is possible that a range of clean coal technologies will have been developed and could be used as a compliance option. Even then, however, there would be considerable pressure to conserve financial resources and to apply such resources to achieving the greatest reductions on the least number of units. This would mean that interest in, and funds available to demonstrate, less efficient retrofit technologies would be very limited. Also, overall interest in developing or using clean coal technologies would be greatly reduced. Resources, both human and financial, would be redirected towards compliance with the required emissions reductions.

### C. The Use of Clean Coal Technologies as a Possible Compliance Option

Sufficient time must be allotted for the demonstration and deployment of clean coal technologies before industry will consider their use. Without this time, the potential users of such technologies will have no information or experience upon which to judge costs, efficiency, reliability and other issues that confront utility management when making choices about emissions reduction options.

It is important to understand that only after successful demonstration and deployment will a particular clean coal technology be considered an option by which to achieve reductions of atmospheric pollutants; however, successful demonstration and deployment does not mean that the technology will be immediately and widely incorporated into the nation's electric generation base thereby achieving significant reductions. The utility industry -- each utility -- will proceed very carefully when applying a new technology. This means that for any given utility, a successfully-demonstrated clean coal technology will be applied first to one unit and then another, before being incorporated into an entire system. This market penetration scenario will be replicated many times over throughout the entire utility industry. Application of clean coal technologies into the entire generation base would be dependent upon many factors and could easily take a decade or more in which to penetrate the market and achieve significant reductions of atmospheric pollutants.

Furthermore, to be ready for widespread commerical applications so that these technologies might contribute to significant reductions of atmospheric pollutants, it will be necessary to initiate immediately the expanded demonstration and deployment program described in this statement. This means that the clean coal technology financial assistance program must be continued and expanded. Also, regulatory impediments at the federal and state levels must be addressed and regulatory incentives substituted in place of existing regulatory disincentives. The most important matters in this regard are the uncertainties associated with regulatory review and the need for mechanisms to better assure cost recovery. Further, some means by which to best assure that investments once made will not be rendered valueless by subsequent government action must be implemented. This is especially true with respect to possible change in environmental regulations which could make certain emissions-reduction technologies valueless.

Finally, those who propose that federal dollars be directed only toward the development of retrofit technologies do not understand, apparently, the barrier which current regulations pose for the development of such technologies or the demands that will be made upon a utility's financial resources if any kind of acid rain control program were enacted. Free choice to demonstrate any clean coal technology should be maintained. In this way, there is still the opportunity to develop those technologies that otherwise will be the technologies of choice for electricity generation and environmental control in the next generation of new powerplants or the capacity additions to existing facilities.

## IV. CONSIDERATIONS OF UTILITY MANAGEMENT TO COMPLY WITH AN ACID RAIN CONTROL PROGRAM

How a utility would comply with an acid rain control program depends upon the specific, and often unique, circumstances of that utility. Of course, the requirements of the control program will also dictate the availability of options. Compliance strategies will be dictated largely by the life-cycle costs of the various alternatives, the availability of technologies, as well as coals or other alternative fuels and, simply, the physical constraints at existing powerplants. For example, the land mass around some powerplants simply cannot accommodate the installation of current-day scrubbers or the disposal of scrubber waste.

With respect to the use of clean coal technologies as a compliance option, important factors to be considered by utility management include: availability and reliability of the technology; performance characteristics with respect to percentage of sulfur and/or NOx removal capability; costs; and, proven reliability.

APPENDIX (Answer to Chairman Sharp's Question #3)

## ENVIRONMENTAL PERFORMANCE OF CLEAN COAL TECHNOLOGIES

| TECHNOLOGY | %SO2 REDUCTION | NOx EMITTED | WASTE CHARACTERISTICS |
|---|---|---|---|
| CONVENTIONAL | | | |
| Coal Cleaning | 10-30 | No Change | Solid disposal |
| Flue Gas Scrubber | 90+ | No Change | Sludge |
| RETROFIT | | | |
| Advanced Flue Gas Cleanup | 90+ | High Reduction[1] | None. Byproduct produced[2] |
| Limestone Injection Multistage Burner | 50-60 | Moderate Reduction | Dry non-toxic powder suitable for landfill |
| Slagging Combustor | 50-90 | Moderate Reduction | Dry non-toxic powder suitable for landfill |
| Gas Reburning | 10-20 | Moderate Reduction | None produced |
| In-Duct Sorbent Injection | 50-70 | No Change | Dry powder suitable for landfill |
| Advanced Coal Cleaning | 30-90[3] | No Change | Solids disposal |
| Coal Slurry | 10-90[4] | No Change | Solids disposal |
| REPOWERING | | | |
| Integrated Gasification Combined Cycle | 95-99 | Moderate Reduction[5] | Usable slag, saleable sulfur and small quantities of other solid wastes |
| Pressurized Fluidized Bed Combustion | 90-95 | Moderate Reduction[5] | Dry granular non-toxic solid waste |
| Atmospheric Fluidized Bed Combustion | 85-90 | Moderate Reduction[5] | Dry granular non-solid waste |

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(Source: "America's Clean Coal Commitment", U.S. Department of Energy, Office of Fossil Energy, February 1987; footnotes are to note comments about the chart by the Coalition)

[1] Most advanced flue gas cleanup systems are not capable of high NOx emissions reductions. Therefore, in general, they should be classified as "NO Change", or, in certain circumstances, "Low to Moderate Reduction". However, if selective catalytic reduction (SCR) is included, "High Reduction" is possible.

[2] This may be true for some plants, however, there may be a significant number of plants that will still require partial or total gypsum disposal on site.

[3] An upper limit of 90% for advanced coal cleaning is optimistic. 70% may be more realistic.

[4] An upper limit of 90% SO2 reduction seems to be too high. 60% may be more realistic.

[5] In our judgement, "Moderate reduction" is not correct. It should be classified as "High Reduction" for gasification and "Moderate to High Reduction" for PFBC and AFBC technologies.

## APPENDIX (Answer to Chairman Sharp's Question #3)

### TECHNICAL AND ECONOMIC PERFORMANCE OF CLEAN COAL TECHNOLOGIES

| TECHNOLOGY | EFFICIENCY | POWER OUTPUT | PLANT LIFE | INCREMENTAL* COST OF ELECTRICITY (mills/kWh) | CAPITAL COSTS ($/kW) |
|---|---|---|---|---|---|
| **CONVENTIONAL** | | | | | |
| Coal Cleaning | Small Increase | No Change | Slight Extension | 2-3 | Fuel Only |
| Flue Gas Scrubber | Decrease | Moderate Decrease | No Change | 9-11[1] | 180-200 |
| **RETROFIT** | | | | | |
| Advanced Flue Gas Cleanup | Decrease | Small Decrease | No Change | 10-12 | 175-190 |
| Limestone Injection Multistage Burner | Decrease | Small | No | 5-8 | 80-110 |
| Slagging Combustor | Small Decrease | Small Decrease | Slight Extension | 1-2 | 50-60 |
| Gas Reburning | No Change | No Change | Slight Extension | Depends on Gas Price | 10-20 |
| In-Duct Sorbent Injection | Small Decrease | Small Decrease | No Change | 2-4 | 40-90 |
| Advanced Coal Cleaning | Small Decrease | No Change | Slight Extension | 6-21 | Fuel Cost Only |
| Coal Slurry | Small Decrease | Small Decrease | No Change | 11-23 | 20-50 |
| **REPOWERING** | | | | | |
| Integrated Gasification Combined Cycle | Moderate Increase | 50-150% Increase 10-30% | Moderate Extension | 1-2[2] | 1100-1300 |
| Pressurized Fluidized Bed Combustion | Slight Increase | 40-50%[3] Increase | Moderate Extension | 4-6 | 800-1000 |
| Atmospheric Bed Combustion | No Change | 10-15% Increase | Moderate Extension | 6-8 | 700-900 |

**SOURCE:** "America's Clean Coal Commitment:, U.S. Department of Energy Office of Fossil Energy, February 1987)

*Assumes base is conventional coal-fired power plant with only particulate removal devices. For repowering technologies, capital costs are relatively high to retrofit technologies because the output, i.e. capacity of the plant is considerably increased. The incremental cost of electricity are those costs associated with reducing emissions from the original plant.

[1] It is our opinion that Conventional Flue Gas Cleanup would have a higher incremental cost of electricity than Advanced Flue Gas Scrubber -- 12 to 14 Mills/kWh. However, if selective catalytic reduction (SCR) is included, Advanced Flue Gas Cleanup could have higher cost of electricity. It should then be reflected in capital cost also.

[2] The Incremental Cost of Electricity for IGCC as referenced in the DOE table is confusing. If Capital Cost of repowering is assumed to be $1000 to 1300/kW, the incremental capital charge alone would be much higher than 1 to 2 mills/kW-hr as predicted by US DOE and might be approximately 10 to 15 mills/kW-hr.

[3] Studies conducted by American Electric Power shows that PFBC Repowering will be capable of maximum net capacity increase by 30% and could be as low as 10%, rather than 40 to 50% stated in the table.

Mr. SHARP. Thank you very much, Mr. Disbrow.

We now welcome Mr. Seth Schwartz with Energy Ventures Analysis, Incorporated.

## STATEMENT OF SETH SCHWARTZ

Mr. SCHWARTZ. Good afternoon, Mr. Chairman.

I am a partner in a consulting firm called Energy Ventures Analysis, and I would like to state that my testimony today is simply my own views and doesn't represent any industry or organization. I will try and answer the questions that you posed in your letter as directly as possible.

The first question related to whether or not clean coal technology would be used in the absence of a control program. There is not a simple answer to that question. The answer is, some of the technologies would be used in the absence of a control program because they have other benefits besides simply environmental control. Those technologies generally relate to the idea of new power generation technologies, especially what has been described as fluidized bed combustion, integrated gasification, and combined cycle. They tend to have limited applications in retrofit situations but are appropriate in certain niches in the market.

So the technologies that relate toward retrofit emissions control are not likely to be used in the absence of either environmental regulation—that includes existing regulations which are continuing to drive new technology applications as well as new regulations or subsidized programs such as those done by State agencies as well as the Federal clean coal technology program.

The second question went to the issue of whether or not society faces a choice between pursuing clean coal technologies, on the one hand, and emissions control programs, on the other hand, and the answer to that, in my mind, is, fairly obviously, no, it does not have to be a choice. We could make it a choice if that is what, in fact, you choose to do.

I think that most people would agree that an immediate program to reduce emissions on a large scale that requires a short compliance horizon, like a 5-year horizon for the electric utility industry, would largely preclude the application of clean coal technologies simply because many of the technologies under development aren't currently available, and in a short compliance time frame utilities are going to be forced to choose what is currently available, which basically goes under the category of retrofit scrubbers of FGD systems or switching to lower sulfur coal. However, clearly, the two programs could be combined if it were deemed to be appropriate.

The key issue as far as allowing clean coal technologies to play a role in an emissions reduction program is to allow sufficient time between the time of enactment of a program and telling people something will be needed toward the time of implementation date, which simply allows enough time for the technologies to be developed, tested, applied on demonstration phases, and then made commercial in sufficient time for construction in the commercial sector.

The advantages and disadvantages of clean coal technologies versus conventional technologies was your next question, and I have to be kind of general in the answer on some of those. The retrofit control technologies, which are generally advanced flue gas desulfurization technologies or low-$NO_x$ technologies of some type, like low-$NO_x$ burners or selective catalytic reduction, offer the fundamental advantage of lower costs of achieving the same controls versus conventional technologies. Especially the advanced scrubbing systems could very well get lower costs for the same kind of reduction as existing technologies, and some of the low-$NO_x$ technologies will provide the ability to reduce $NO_x$ emissions where, to a large extent, it is not available today beyond a certain level.

The new power generating technologies, like gasification, combined cycle, and fluidized bed combustion, provide a number of other advantages, especially in the area of lower total cost of generation, more efficient generation; in retrofit applications fluidized bed combustion can result in a substantial increase in generating capacity; and these are all advantages that are beyond the advantage simply of controlling emissions. But these all are higher capital cost approaches, and the only reason why utilities will choose these type of technologies is because they offer other advantages, and for each utility situation those advantages or disadvantages versus conventional technologies will be different.

Your next question went to the issue of when these clean coal technologies will be available to meet the emissions control program, and I'll make a generic statement in response to that, but it is really not that simple. There are a lot of technologies under development, and it is not really clear exactly how well they will do until the program that is under way is tested and we have more information, with the caveat that if these technologies are successful in their development, most of them should be commercially available in the 1995 to 2000 time frame. Certainly, you will not see a rush of many utilities to order most of these technologies in 1989, but in the period 1995 to 2000 I think they probably will be available, provided they are successful in their demonstration program.

Some technologies are currently available, like atmosphere fluidized bed combustion on very small-scale applications, but the question about making them a part of a larger emissions control program requires the development to larger sizes.

The other part of the question was, how would one accelerate the availability of these technologies? I think the simple answer is to spend money, like you are doing.

Your last question essentially says that some assert that powerplants with scrubbers are costly, unreliable, and inefficient; is that a fair characterization? I think that is not a fair characterization. It should be posed as a question, "compared to what?" Compared to powerplants without scrubbers and with no flue gas desulfurization, yes, they are more costly, less reliable, and less efficient. But compared to other choices, scrubbers are, generally speaking, a proven technology that work reasonably well, but they do cost money and they do take away from the efficiency and the capacity of the unit.

A question about whether or not these technologies, scrubber technologies, will continue to improve, I think the answer is yes, it will continue to improve. I don't think we are looking at any tremendous breakthroughs in the technology, but I think we have seen improvements over the last 10 years from some of the early disastrous applications in the early 1970's of scrubbers, and I think we will continue to see improvements, especially in the areas of scrubber chemistry control, material selection, and waste disposal.

I thank you for your time, and that concludes my statement.

[The prepared statement and attachment of Mr. Schwartz follow:]

# PREPARED TESTIMONY OF MR. SETH SCHWARTZ ON CLEAN COAL TECHNOLOGY AND EMISSIONS REDUCTIONS

HOUSE COMMITTEE ON ENERGY AND COMMERCE
SUBCOMMITTEE ON ENERGY AND POWER

June 22, 1988

I am pleased to present testimony on the advantages of clean coal technologies as a means of reducing emissions of sulfur and nitrogen oxides. This testimony reflects only my own opinions, and should not be constructed to be the opinions of my clients or any particular industry. I have directly addressed the Subcommittee's questions, but I have changed the order slightly for ease of presentation.

**(1) The advantages and disadvantages of clean coal technologies relative to conventional technologies or other strategies for emissions reductions.**

In order to address this issue, it is first necessary to briefly describe and define the various technologies and emissions reduction strategies. My understanding of "conventional technologies" for emissions reductions is that it includes commercially-available flue gas desulfurization systems (scrubbers) and coal cleaning plants. The "other strategies" for emissions reductions are, in my interpretation, switching fuel supplies to low-sulfur coal or natural gas.

Clean coal technologies incorporate a wide variety of technologies that yield lower emissions from coal and are not presently commercially-available. The advantages and disadvantages of these technologies vary widely. In order to answer the Subcommittee's questions, I feel that it is necessary to categorize the clean coal technologies by their fundamental characteristics.

The attached Table 1 is a brief summary of the 54 projects proposed for funding under the second round of the Clean Coal Technology Program. As shown on this table, the principal clean coal technologies are $SO_2/NO_x$ emissions control, FBC, IGCC, and coal preparation. These technologies have different applications and costs compared to existing options, which are scrubbing and switching.

Conventional scrubbers can be applied to retrofit existing coal-fired boilers, but the cost varies with the characteristics of the powerplant. Large (400-1300 MW), relatively new (1965-1975) boilers with ample space near the stack can have scrubber retrofit costs very similar to the cost of building scrubbers at new plants. Small, old plants with space constraints can cost twice as much as new installations.

The other principal existing option is switching to low-sulfur coal. The cost of switching is principally function of the differential prices for high-sulfur and low-sulfur coal, the increased transportation costs, and the capital costs associated with changing coal supplies and specifications (precipitators, pulverizers, boiler modifications, and handling facilities). Because low-sulfur coal is generally found in different producing regions from high-sulfur coal and powerplants have differing locations and delivery modes, the increased transportation cost for coal switching varies widely by powerplant. Some plants would have no increase in transportation costs and can be relatively cheap to switch, while others can have very high switching costs.

In short, given current technology, some powerplants would retrofit scrubbers, some would switch coals, and others would be retired (where scrubbing and switching are both prohibitive in cost), if required to reduce $SO_2$ emissions. The different clean coal technologies have different advantages versus these conventional approaches.

The developing $SO_2$ emissions control technologies can offer an improved version of scrubbing. They have the potential of reducing the costs and improving the efficiency of conventional scrubbers, which would reduce the cost of emissions control and make switching away from local coal less attractive. As a modification of existing technology, these technologies have no disadvantages in comparison, if they are successful.

The developing $NO_x$ control technologies offer the ability to reduce these emissions substantially. Although low-$NO_x$ burners have been developed (in a significantly part due to EPA's research programs) they are not widely installed and would probably be considered "clean coal technologies" not yet commercially-available. These burners may achieve approximately 50 percent reductions in $NO_x$ emissions at relatively low costs. The selective catalytic reduction technologies can achieve much lower emission rates at much higher costs.

Fluidized bed combustion (FBC) is a completely different boiler design from the conventional units that comprise virtually all existing utility boilers. FBC can be a low-cost means of achieving $SO_2$ and $NO_x$ emissions in new units comparable to scrubbers and low-$NO_x$ burners. The cost of retrofitting FBC to existing coal-fired units is very high, because the existing boiler is scrapped. FBC retrofit will increase the capacity and efficiency and extend the life of existing units, which can have great value if the existing boiler is in poor condition. Therefore, FBC has a logical niche as a retrofit application for old, small boilers where scrubbing costs are high anyway. FBC would not be a low-cost retrofit for most large, new units, which comprise the bulk of the $SO_2$ and $NO_x$ emissions.

IGCC combines coal gasification with a gas turbine and a waste heat boiler. This technology has strong potential for new powerplants which will be needed in the late 1990's. It achieves very high levels of $SO_2$ and $NO_x$ removals. It can be retrofit on existing gas turbines and gas-fired boilers as a means of converting them to coal. IGCC is not applicable as a retrofit technology on existing coal-fired boilers.

The proposals for new coal preparation technologies fall into three basic types. Four projects are to develop techniques to dry the western high-moisture, low-sulfur, subbituminous coals, to make them technically suitable for firing in boilers designed for eastern bituminous coals. These technologies could greatly reduce the cost of coal switching for lower $SO_2$ emissions. This has a political disadvantage of increasing the coal production and employment dislocations caused by emissions reductions. The advanced coal cleaning processes involve improvements to existing cleaning plant technologies, which could reduce costs of using local coals at moderate level of $SO_2$ reductions.

The micropulverized and coal slurry technologies involve fundamental changes in coal preparation which could substantially reduce emissions.

**(2) The use of clean coal technologies in the absence of an emissions control program.**

Many of the clean coal technologies offer only the value of reduced $SO_2$ and $NO_x$ emissions in return for the increased cost of the technology. Owners of existing coal-fired boilers would have no incentive to retrofit these technologies in the absence of an emissions control program. All of these technologies might be adopted for construction of new powerplants, to a large extent in order to comply with new source performance standards.

FBC might be applied to retrofit existing boilers in the absence of a control program. The benefits of life extension, increased capacity, and improved efficiency make FBC a viable option for an old unit instead of retirement and replacement. IGCC might be applied to retrofit existing gas-fired units to convert them to coal, if there were a sharp increase in gas prices. The western coal drying technology will be used, if successful, as a means of substituting low-cost western coals in units designed for midwestern coals.

**(3) The choice between clean coal technologies and implementation of an emissions reduction program.**

An immediate emissions reduction program could preclude the widespread use of clean coal technologies if there is not sufficient time to develop the technologies. The key requirement for clean coal technologies to play a large role in emissions reductions is to allow enough time (10-15 years) between the passage of emissions reduction legislation and the final implementation date. The passage of legislation would give technology vendors ample motivation to invest in the development of clean coal technologies, while a delayed implementation schedule would give utilities enough time to wait for the technology to be commercially-available and to allow for construction.

The level of emissions reduction required will also play an important role in determining the application of clean coal technologies. A low mandated emissions rate (under 1.2 pounds $SO_2$ per MMBtu) would force the application of technology, whereas a higher rate (over 1.6 pounds $SO_2$) would mean that low-cost coal switching would be the principal strategy.

**(4) The availability of clean coal technologies.**

Some technological approaches to the removal of $SO_2$ and $NO_x$ from coal combustion are available today. Conventional wet and dry scrubbing are widely used in the industry. Atmospheric FBC is commercially-available at small boiler sizes (under 150 MW). Low-$NO_x$ burners for wall-fired units are probably also commercial. Coal cleaning plants that remove 20-40 percent of the sulfur from raw coal are common in the industry.

Some of the clean coal technologies that are under development should be commercial by the mid-1990's, if the R&D programs continue. AFBC should be scaled up to larger sizes (150-300 MW) in this period. Advances in conventional scrubbers are continuing. Some of the new flue gas desulfurization technologies (furnace injunction, duct injection, etc.) should be successful. Low-$NO_x$ burners should be available for all dry-bottom boilers in this period.

The more complex clean coal technologies may be available by 2000. These include pressurized FBC, IGCC, and selective catalytic reduction for $NO_x$ removal. The success of these technologies depends partly on the current demonstration program.

The principal step needed to meet this schedule for these technologies is to continue the Clean Coal Technology Program. Commercial-scale demonstrations have been proposed in the second round for improved wet scrubbing (100 MW), advanced wet scrubbing (529 MW), furnace injection (156 MW), duct injection (70 MW), wall-fired LNB (500 MW), tangentially-fired LNB (180 MW), AFBC retrofit (160 MW), IGCC (400 MW), and PFBC retrofit (330 MW), among others. If possible, all of these projects should be funded to provide utilities and vendors complete information as to the commercial performance and cost.

(5) **The cost, reliability, and efficiency of scrubbers.**

It is not fair to describe scrubbers as costly, unreliable, and inefficient. The question should be: Compared to what? They are certainly more costly, less reliable, and less efficient than powerplants with no $SO_2$ emissions controls. It is not clear, however, that other technologies for $SO_2$ removal will be substantially superior to scrubbers. As with any new technology, there have been major advances since the initial projects in the early 1970's. These advances include improved design of the gas/liquid contact chamber, better design and selection of materials, and better techniques for sludge handling. Scrubber improvements will continue, especially in the areas of understanding scrubber chemistry and better materials.

Scrubbers have a number of advantages and disadvantages compared to switching to low-sulfur coal. The principal advantage is that the utility can continue to use local coal, with lower mine prices and transportation costs. The disadvantage is that scrubbers have higher capital and non-fuel operating costs. Scrubbers will be more cost-effective in some cases, while switching will be preferred in others.

Many of the new FGD technologies under development offer the promise of lower costs than conventional scrubbers, but they generally cannot achieve as great a removal percentage. IGCC and FBC may offer lower costs and greater removal efficiency than scrubbers for new units, but scrubbers are more appropriate for most coal-fired retrofit applications.

Table 1

SUMMARY OF PROPOSALS TO THE CLEAN COAL TECHNOLOGY PROGRAM
MAY 1988

| | | |
|---|---|---|
| Retrofit Emissions Control Technologies | | |
| $SO_2$: | 3 | commercial-scale demonstrations (785 MW) |
| | 3 | testing and demonstration programs |
| $NO_x$: | 2 | commercial-scale demonstrations (680 MW) |
| | 5 | testing and demonstration programs |
| $NO_x/SO_x$: | 1 | commercial-scale demonstration (33 MW) |
| | 5 | testing and demonstration programs |
| | 19 | |
| Fluidized Bed Combustion | | |
| | 4 | repowering of existing utility coal-fired boilers (600 MW) |
| | 2 | conversion of gas-fired utility boiler to coal (500 MW) |
| | 4 | new industrial and cogeneration boilers |
| | 4 | testing and demonstration programs |
| | 14 | |
| Integrated Gasification Combined Cycle | | |
| | 1 | new utility powerplant (400 MW) |
| | 3 | retrofit demonstrations on existing gas-fired boilers |
| | 1 | continuing test program |
| | 5 | |
| Coal Preparation | | |
| | 4 | western coal drying plants |
| | 3 | advanced coal cleaning tests |
| | 3 | modified coal preparation |
| | 10 | |
| Other Technologies | | |
| | 6 | (flue cell, synfuel, efficiency improvement, mine fire, coke gas, sludge recovery) |
| | **54** | **TOTAL** |

Mr. **Sharp**. Thank you very much, Mr. Schwartz.

We now welcome Mr. Paul Feira of the Industrial Gas Cleaning Institute.

## STATEMENT OF PAUL J. FEIRA

Mr. **Feira**. Thank you, Mr. Chairman and members of the subcommittee.

My name is Paul Feira. I am president of Wheelabrater Air Pollution Control, located in Pittsburgh, Pennsylvania. I am appearing here today in my capacity as president of the Industrial Gas Cleaning Institute. IGCI is the national trade association of principal manufacturers of stationary source air pollution control equipment. We very much appreciate the opportunity to participate in today's hearing.

IGCI's members include manufacturers of flue gas desulfurization systems, also known as FGD systems or scrubbers, that could be retrofitted on utility boilers to satisfy the sulfur dioxide reduction requirements of the pending acid rain control bills. In addition, some of IGCI's members have also submitted proposals to the DOE in connection with DOE's program to develop clean coal technology.

IGCI believes that a utility required to reduce $SO_2$ emissions should be free to shop in the marketplace for the best pollution reduction option. IGCI does not want a forced scrubber bill, but we do believe that utilities will choose FGD over clean coal technologies in many cases because of FGD's proven higher reliability, $SO_2$ removal efficiency, and cost-effectiveness. In addition, FGD retrofits can be connected during scheduled annual outages compared to perhaps 2 years of downtime for many clean coal technology retrofits. Attachments to IGCI's written statement expand upon these points.

The FGD processes now in operation are well proven. Current data for domestic FGD systems show 144 systems in operation and 7 systems under construction. The current total FGD control capacity in the United States is nearly 63,000 megawatts. The reliability of these systems is exceptionally high, as shown by data from the utility industry's North American Electric Reliability Council. These systems have a well demonstrated and well recognized removal efficiency of greater than 90 percent. These efficiencies are easily achieved even with high-sulfur coals. Use of FGD systems, therefore, also preserves high-sulfur coal markets.

There is also no question about the capacity of the U.S. air pollution control industry to retrofit existing steam generators with FGD systems to meet the requirements of an acid rain control bill. The pollution control system suppliers have the process and system design engineering expertise in place now, and it is this expertise that is the critical factor in assuring adequate capacity.

The cost of the FGD retrofit part of an acid rain bill rests on numerous assumptions, and relating this cost to clean coal technology costs is harder still, since these costs are speculative. IGCI has testified several times, however, and still believes that estimates of $15–$16 billion a year for a 10-million-ton $SO_2$ reduction are two to three times too high based on our detailed analysis of FGD plans at two utility plants. FGD manufacturers are eager to compete in the marketplace with clean coal technologies to keep costs as low as possible.

IGCI believes it is prudent to make sure that in solving an air pollution control problem we do not create a solid waste problem. In this regard, let me also assure you that, as EPA has recently concluded, FGD systems are highly efficient and, as a result, produce less waste than many alternative technologies.

IGCI believes one of the best incentives to development of clean coal technologies is to require $SO_2$ reductions by a date certain. As the Senate Environmental Committee concluded recently, "A clean coal technology program can only be implemented hand in hand with a control program for the precursors of acid deposition. Without the control program, there is, in fact, no market for most of the technologies which will be demonstrated."

To delay action on the premise that heretofore undeveloped technologies will reduce the costs significantly or at all seems questionable since development of these technologies rests on a number of future R&D successes. To delay also assumes that these developing technologies will be quickly and universally adopted by a utility industry which historically has shown capital and risk aversion due to legitimate concerns about reliability.

If one assumes, as many scientists and others have concluded, that acid rain is at present causing billions of dollars a year in environment and human health damage, then sound public policy would seem to require immediate reductions, especially since, as I have said, technology is currently available to do the job.

Thank you for the opportunity to appear and make IGCI's views known.

[Testimony resumes on p. 550.]

[The prepared statement and attachments of Mr. Feira follow:]

Statement By

PAUL J. FEIRA
President
The Industrial Gas Cleaning Institute, Inc.

Good morning. My name is Paul Feira. I am President of Wheelabrator Air Pollution Control, Inc., in Pittsburgh, Pennsylvania. I am appearing here today in my capacity as President of the Industrial Gas Cleaning Institute (IGCI).

IGCI is the national trade association of principal manufacturers of stationary source control equipment. We very much appreciate this opportunity to participate in today's hearing.

IGCI's members include manufacturers of flue gas desulfurization systems -- also known as FGD systems or scrubbers -- that could be retrofitted on utilities to satisfy the sulfur dioxide ($SO_2$) reduction requirements of the pending acid rain control bills. In addition, some of IGCI's members have also submitted proposals to the U.S. Department of Energy (DOE) in connection with DOE's program to develop clean coal technology.

IGCI believes that a utility required to reduce $SO_2$ emissions should be free to shop in the market place for the best pollution reduction option. IGCI does not want a forced-scrubbing bill. But we do believe that utilities will choose FGD over clean coal technologies in most cases because of FGD's proven higher reliability, $SO_2$ removal efficiency, and cost-effectiveness. In addition, FGD retrofits can be connected during scheduled annual outages compared to two years of downtime for many clean coal technology retrofits (e.g. fluidized bed combustion). Attachments to IGCI's written statement expand upon these points.

The FGD processes now in operation are well proven. Current data for domestic FGD systems show 144 systems in operation and 7 systems under construction. The current total FGD-controlled capacity in the United States is nearly 63,000 MW.[1]

The reliability of these systems is exceptionally high as shown by data from the utility industry's North American Electric Reliability Council.[2] This high reliability has been achieved through a better knowledge of the process chemistry, selection of proper materials of construction, the use of redundant equipment in critical areas, and to a great extent, experience by the utilities in the operation of such plants.

Currently available FGD systems would also without question get the job done. These systems have a well-demonstrated and well-recognized removal efficiency of greater than 90 percent.[3] These efficiencies are easily achieved even with high sulfur coals. Use of FGD systems therefore also preserves high sulfur coal markets.

There is also no question about the capacity of the U.S. air pollution control industry to retrofit existing steam generators with FGD systems to meet the requirements of an acid rain control bill, such as the ones I alluded to a moment ago. The pollution control system suppliers have the process and system design engineering expertise in place now. And it is this expertise that is the critical factor in assuring adequate capacity.

Although the pollution control industry is operating below is pre-1980 level, emission reduction technology has matured by experience from operating facilities. This experience has contributed to better and more standardized designs. Recent developments with computer-assisted design and manufacturing will also enhance the productivity and capabilities of existing industry engineering staffs.

Recent DOE analyses calling into question the adequacy of the FGD industry capacity fail to account sufficiently for the significant number of scrubber suppliers who will enter the market when acid rain legislation is enacted. By our account, DOE has ignored at least 50 percent of the companies that have the potential to be reliable, but which are not at present in the market. The DOE study also stands at odds with the response of pollution control suppliers to West Germany's adoption in 1983 of stringent $SO_2$ reduction requirements necessitating retrofit installation of scrubbers for 110 installations (totalling 34,000 MW) within five years. Although only six suppliers have been active in West Germany, they appear close to satisfying the difficult retrofit requirements there. A similar situation is emerging now in England where FGD system capacity has increased in response to the ambitious scrubber retrofit program there; indeed, competition has been fierce.

In short, the pollution control industry in the U.S. can satisfy fully both the number of and schedule for retrofit of FGD systems likely to occur in the U.S. under acid rain control legislation. The industry's current capacity, expected growth, and experience worldwide compel this conclusion.

The cost of the FGD retrofit part of an acid rain bill of course rests on numerous assumptions, and relating this cost to clean coal technology costs is harder still since those costs are speculative. IGCI has testified several times, however, and still believes that estimates of $15-16 billion a year for a 10 million ton $SO_2$ reduction are 2-3 times too high based on our detailed analysis of FGD plans at two utility plants. And the FGD manufacturers are eager to compete in the marketplace with clean coal technologies to keep costs as low as possible.

I would also like to note that all dollars spent on retrofitting FGD systems will be recycled in the economy, creating tens of thousands of new American jobs, many of which would be highly skilled.

IGCI believes it is prudent to make sure that in solving an air pollution problem, we do not create a solid waste problem. In this regard, let me also assure you that, as EPA has recently concluded, FGD systems are highly efficient and, as a result, produce less waste than many alternative technologies. For example, the total waste volume from a gypsum-producing FGD system would be only about 60 percent of the volume of waste solids produced by fluidized-bed combustion systems, which are being highly touted as a clean coal technology alternative to scrubbers. In addition, mixing the FGD wastes with the coal ash and lime can create a substance that is much easier to dispose of than the coal-ash alone. Thus, as EPA has concluded, an FGD system does not create a new waste disposal problem where none existed before, and may actually help solve an existing one.

* * *

IGCI believes that one of the best incentives to development of clean coal technologies is to require $SO_2$ reductions by a date certain. As the Senate Environment Committee concluded, "a clean coal technology program ... can only be implemented hand-in-hand with a control program for the precursors of acid deposition. Without the control program there is, in fact, no market for [most of] the technologies which will be demonstrated ...."[4]

To delay action on the premise that heretofore undeveloped technologies will reduce the cost significantly, or at all, seems questionable since development of these technologies rests on a number of future R&D successes. To delay also assumes that these developing technologies will be quickly and universally adopted by a utility industry which historically has shown capital and risk aversion due to legitimate concerns about reliability.

If one assumes -- as many scientists and others have concluded -- that acid rain is at present causing billions of dollars a year in environment and human health damage, then sound public policy would seem to require immediate reductions, especially since, as I have said, technology is currently available to do the job.

Thank you for this opportunity to appear and to make IGCI's view known.

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[1] PEI Associates, Inc., "Project Summary: Utility FGD Survey, January-December 1986," U. S. Department of Energy, November 1987, pp. 4-20.

[2] North American Electric Reliability Council, "General Availability Report, 1982-1986," 1987, Passim.

[3] PEI Associates, Inc., supra n. 1, pp. 24-25; Senate Report No. 231 (to accompany S. 1894), 100th Cong., 1st Sess. pp. 73, 117-118 (1987).

[4] Senate Report No. 231, supra n. 3, p. 118.

ATTACHMENT 1

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# NEWS

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November 1987

## INDUSTRIAL GAS CLEANING INSTITUTE REPORTS ADEQUATE CAPACITY TO MEET ACID RAIN BILL RETROFIT REQUIREMENTS

The flue gas desulfurization systems ("scrubber") industry has adequate capacity not only to retrofit the controls likely to be needed under pending acid rain bills to reduce $SO_2$ emissions, but to do so within the time constraints these bills set out, according to the Industrial Gas Cleaning Institute (IGCI). IGCI is the national association of stationary source air pollution control equipment manufacturers.

The IGCI report responded to a recent U.S. Department of Energy (DOE) finding[1] that the pollution control industry could not meet the time constraints for installation of controls required by pending acid rain bills.

"The fabrication, machinery, electrical, and instrumentation sectors -- together with the construction industry traditionally servicing the utility industry -- have the capacity to build and erect the controls required in a timely manner. The pollution control system suppliers have the process and system design engineering expertise in place now. This expertise is the critical factor in assuring adequate capacity. Necessary detail engineering manpower is readily available either in-house (through parent or sister companies) or by tapping the large pool of unemployed engineers and designers," stated Jeffrey C. Smith, IGCI's Executive Director.

"Although the pollution control industry is operating below its pre-1980 level," Smith added, "emission reduction technology has matured by experience from operating facilities. This experience has contributed to better and more standardized designs. Recent developments with computer-assisted design and manufacturing (CAD/CAM) will also enhance the productivity and capabilities of existing industry engineering staffs."

"The Department of Energy study fails to account sufficiently for the significant number of scrubber suppliers who will enter the market when acid rain legislation is enacted. Companies which DOE ignored that have the potential to be reliable suppliers in addition to the 14 DOE identified include Bischoff, Burns & McDonald, Deutsche-Babcock, Dravo, Foster-Wheeler, Lodge-Cottrell, Lurgi, and no doubt others."

"The DOE study also stands at odds with the response of pollution control suppliers to West Germany's adoption in 1983 of stringent $SO_2$ reduction requirements necessitating retrofit installation of scrubbers for 110 installations (34,000 MW) within five years. Although only six suppliers have been active in West Germany, they appear close to satisfying the difficult retrofit requirements there. Equally instructive is the situation in England, where 12 suppliers have emerged in response to the developing retrofit market there, which is much smaller than the market acid rain legislation is expected to create here."

"Finally, DOE incorrectly assumes that the bid preparation process will not begin until year 4 after enactment of acid rain legislation, when in fact it will begin almost immediately."

"In short," Smith concluded, "the pollution control industry in the U.S. can satisfy fully both the number of and schedule for retrofit of flue gas desulfurization systems likely to occur under U.S. acid rain control legislation. The industry's current capacity, expected growth, and experience worldwide compel this conclusion."

IGCI participates in the technical aspects of the national debate regarding acid rain control legislation as part of its overall mission to assure a strong and workable national air quality policy that promotes public health, environmental quality, and industrial progress.

[1] PEI Associates, Inc. for U.S. Department of Energy (Contract No. DE-AC01-85MA00205, Task 10, PN 3685-10). Vendor Capability for Supplying FGD Systems for Coal-Fired Boilers Under Acid Rain Emission Reduction Conditions. November 1987.

ATTACHMENT 2

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April 4, 1988

## ACID RAIN CONTROLS WOULD CREATE THOUSANDS OF JOBS, INDUSTRY ANALYSIS FINDS

### I. Statement

"A recent analysis by the Industrial Gas Cleaning Institute reveals that a 10-12 million ton $SO_2$ reduction requirement such as that contained in pending Congressional acid rain proposals could create between 180,000 and 600,000 person-years of employment. These person-years of employment are the equivalent of 4,500 to 15,000 lifetime (40-year) jobs. Alternatively, they may be viewed as the equivalent of 18,000 to 60,000 new jobs created for the duration of the expected phased, ten-year period of retrofit activity. These thousands of new American jobs--many of which would be highly skilled -- should be balanced against any economic costs predicted to occur because of acid rain legislation," stated Jeffrey C. Smith, Executive Director of the Industrial Gas Cleaning Institute (IGCI). IGCI is the national association of stationary source air pollution control equipment manufacturers.

"IGCI estimates that utility decisions to meet sulfur dioxide ($SO_2$) reduction requirements by retrofitting flue gas desulfurization (FGD) systems (also known as scrubbers) could create the equivalent of 1,500 to 5,000 lifetime jobs (60,000 to 200,000 person-years of employment) for engineers, architects, construction workers, and others in the FGD sector of the air pollution control industry alone. Dollars spent on these acid rain controls would be recycled in the Nation's economy, creating the equivalent of as many as 3,000 to 10,000 additional permanent jobs (120,000 to 400,000 person-years of employment) outside of the air pollution control industry."

"If utilities chose to reduce $SO_2$ emissions through the installation of flue gas desulfurization systems -- as we believe many would -- existing jobs in the high-sulfur, coal-mining industry would likely also be preserved. Additionally, most of the new fabrication and construction jobs would be in the very states concerned with a potential loss of coal-mining jobs."

"It is important to note also that these new American jobs stand in addition to the avoided cost of reportedly hundreds of millions of dollars of damage acid rain causes to human health and the manmade and natural environment. The economic benefits of acid rain control legislation are thus real and significant, just like the economic costs."

"The purpose of IGCI's analysis is not to predict exactly how many jobs acid rain control legislation would create. Rather, IGCI sought to quantify in a simple, straight-forward manner the possible numerical range of jobs that might be created because of utility decisions to retrofit FGD systems. Obviously, these new jobs would be only part of the economic result of implementation of acid rain control legislation. But these potential new jobs suggest that the direct economic benefits of such legislation are substantial, and therefore should be considered along with the economic costs in the national debate regarding acid rain control legislation," Smith concluded.

## II. Background

In order to estimate the direct employment in the FGD sector of the air pollution control (APC) industry acid rain legislation might create, IGCI estimated the person-years involved in the retrofit of a typical-size (500 MW) power plant with a FGD system. IGCI based its estimate on members' experience with actual systems. The analysis covered person-years attributable to specification and bid preparation (including unsuccessful bids); engineering, design and purchasing (e.g. drawing preparation, specifications, and purchasing documents); basic materials (e.g. steel, chemicals, ceramics), shop fabrication, equipment assembly, inspection, and shipment; erection (including site preparation for construction), supervision, and testing; start-up and operation assistance (by FGD contractor or A/E) for one year. IGCI considered person-years contributed by the utility's staff, as well as architect/engineers, FGD contractors, fabricators, equipment suppliers, and erection subcontractors.

IGCI's job figures do not include jobs related to operation of the FGD systems by utility personnel or to the delivery and processing of the alkali. The job figures also do not include jobs that will be created due to compliance with the $NO_x$ reduction requirements of pending acid rain legislation.

Based on this analysis of a typical 500 MW FGD system retrofit job, IGCI estimated that pending legislation calling for a 10-12 million ton $SO_2$ reduction could create from 60,000 to 200,000 person-years of employment in the APC industry alone. IGCI noted that if one assumes that 30,000 MW would be retrofitted with FGD systems to comply with $SO_2$ reduction requirements, then the figure would be closer to 60,000. If 100,000 MW would be retrofitted, as estimated by one utility spokesman[1], the figure would be closer to 200,000 person-years.

Economists often multiply the number of created direct person-hours by two (or sometimes three) to estimate roughly the number of indirect (non-APC industry) jobs created. Thus, the total indirect person-years acid rain legislation could create in this industry might range from 120,000 to 400,000.

Total direct plus indirect person-years of employment would thus be 180,000 to 600,000. Assuming a 40-year work-life per worker, this corresponds to the creation of 1,500 to 5,000 permanent (lifetime) jobs in the FGD sector of the APC industry, and 3,000 to 10,000 indirect jobs. The total lifetime jobs created could thus range from 4,500 to 15,000.

The FGD system-related economic activity acid rain legislation might create would likely be phased, taking place over a ten-year period. Therefore, the 180,000 to 600,000 person-years created could also be divided by ten to express the 18,000 to 60,000 jobs created for the duration of the retrofit activity.

IGCI believes acid rain legislation should give a utility freedom to choose the means for achieving the required $SO_2$ emission reductions. IGCI assumed, however, that a large number of affected utilities would retrofit FGD systems. FGD systems would compete strongly in the marketplace of $SO_2$ reduction options because they are well-demonstrated with a well-recognized removal efficiency of greater than 90 percent[2] and extremely high reliability.[3] IGCI did not consider clean coal technologies because most utilities reportedly consider them either inadequately demonstrated with too high a technical risk or inappropriate for large units.[4] IGCI also did not consider coal-switching because many low-sulfur coals have different characteristics than the high-sulfur coals being burned, and changing coals could require modifications in unit operations, equipment changes, and unit derating.[5] In addition, because the largest amount of low-sulfur coal is in the West, the cost of transporting large amounts of coal makes wide-spread fuel switching in the East impracticable.[6]

IGCI noted that FGD systems are essentially of two types: dry and wet.

In a dry system, an alkaline solution or slurry is atomized in the flue gas and evaporates to dry particles while reacting with the $SO_2$. The reaction products are collected, along with the coal ash, by a fabric filter or electrostatic precipitator and disposed of a dry powder waste material. There is no requirement for a sludge handling system.

In a wet system, the $SO_2$-containing flue gas reacts with a shower of lime or limestone slurry drops, producing a slurry or "sludge." The reacted slurry can be oxidized or purified to produce gypsum, which can be easily landfilled or even sold commercially as wallboard. The latter case relieves the boiler owner of a landfill problem, creates a potential source of revenue, and reduces the need for imported gypsum.

The FGD industry has adequate capacity to retrofit the controls likely to be required within the time frames of pending acid rain control bills. The industry's present capacity, expected growth in response to a new market, and current success in West Germany and elsewhere in meeting significant $SO_2$ reduction requirements support this conclusion.

IGCI prepared this analysis as part of its mission to assure a strong and workable national air quality policy that promotes public health, environmental quality, and industrial progress. As the primary representative of manufacturers of air pollution control systems and associated components, the Institute seeks to evaluate and respond to regulatory and legislative initiatives and establish technical standards to the benefit of all citizens.

[1] Mannella, G. G., "Statement of K. E. Yeager, Vice President, EPRI, Palo Alto, CA," Before the Subcommittee on Environmental Protection, Senate Committee on Environment and Public Works, U.S. Senate, March 4, 1987.

[2] Industrial Gas Cleaning Institute (IGCI), "Acid Rain Control Briefing Document on Retrofitting Flue Gas Desulfurization Systems to Existing Coal-Fired Boilers," July 1987, Pages 5-10; PEI Associates, Inc., "Project Summary: Utility FGD Survey, January-December 1986," U.S. Department of Energy, November 1987, Pages 24-25; Senate Report No. 231 (to accompany S. 1894), 100th Cong., 1st Sess. Pages 73, 117-118 (1987) ("Senate Report").

[3] North American Electric Reliability Council, "General Availability Report 1982-86," 1987, passim; IGCI supra note 2, Page 26.

[4] Electric Power Research Institute (EPRI), "Coal Markets and Utilities' Compliance Decisions" (EPRI P-5444), September 1987, Pages 1-10, 1-11.

[5] Id.

[6] Senate Report, supra note 2, page 71.

ATTACHMENT 3

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# IGCI QUESTIONS USEFULNESS OF DOE REPOWERING REPORT IN ACID RAIN CONTROL DEBATE

## I. STATEMENT

The Industrial Gas Cleaning Institute (IGCI) has serious doubts whether conclusions in a recent U.S. Department of Energy (DOE) repowering report[1] are valid reasons to oppose legislated acid rain controls. The DOE report assesses the sulfur dioxide ($SO_2$) reductions the utility industry might achieve through repowering aging coal-fired power plants with new clean coal technology. It concludes that repowering could potentially reduce $SO_2$ emissions -- a precursor of acid rain -- by four to nine million tons by the year 2010, thereby achieving most of the ten to twelve million ton $SO_2$ reduction required under pending acid rain control bills.[2]

IGCI is the national association of stationary source air pollution control manufacturers.

"Repowering technologies may be important considerations for the utility industry in planning to meet future power capacity and air quality requirements," stated Jeffrey C. Smith, IGCI Executive Director. "But the DOE report fails to make a valid case for predicting the size or timing of any repowering-related $SO_2$ reductions. If Congress desires to reduce acid rain for the current and next generation of Americans, then it must require $SO_2$ reductions rather than rely on the hope that an evolution of repowering technologies will fix the problem naturally."

"To reach its conclusions about the effectiveness of repowering technologies to reduce $SO_2$ emissions in the intermediate term (by the year 2010), DOE assumes a 'maximum potential market' for these technologies. This theoretical maximum potential market is, however, unlikely to resemble the actual market penetration. In short, the DOE report by its own admission uses unrealistic assumptions about the market penetration of repowering technologies and assumes that these capital intensive, largely undemonstrated, and thus high risk technologies will be quickly and universally adopted by a utility industry which has historically shown capital and risk aversion."

"Moreover, the DOE study contains a number of assumptions all of which further inflate the likely $SO_2$ reductions and overall cost-effectiveness of the repowering scenario. These assumptions, recognized in critical comments by the U.S. EPA, include use of unreasonably high costs for conventional technology and low costs for repowering technology, and unreasonably high predictions of future utility baseload capacity needs."

"As a result, reliance on the DOE repowering study by groups or individuals opposed to current legislative acid rain control proposals both misinterprets the report and fails to appreciate its weaknesses," Smith concluded.

## II. BACKGROUND

DOE does not deny that it based its repowering scenario on the maximum potential market penetration for repowering technologies, as opposed to the likely market penetration.

DOE qualified its conclusions this way:

> "[I]t is important to note that the levels of emission reduction stated above represent the maximum potential for repowering technologies. Actual incorporation of these technologies by the electric utility industry would depend on a number of additional factors not considered in this study that could result in lower market penetration of these technologies than indicated in the study."[3] (DOE's emphasis)

The theoretical maximum potential market penetration of repowering technologies and the probable market penetration are apt to be quite different. As recognized by the U.S. Environmental Protection Agency in comments highly critical of the DOE study, before multiple orders of repowering technologies can be expected, utilities will require at least two to three years of successful operating experience from a commercial prototype plant operating successfully in a utility environment.[4] Such experience is years away. And demonstration of a repowering technology at one site does not by itself demonstrate the technological and economic feasibility of deploying the technology throughout the industry.

Utilities have obvious and laudable concerns about reliability, and have understandably shown reluctance traditionally to venture into capital intensive, high-risk, and incompletely demonstrated technologies. Once technologies are commercially available, even if they are demonstrated to have a slight economic advantage over conventional alternatives, it is not realistic to assume as DOE did that they will immediately take over 100 percent of the market for baseload capacity increases.

DOE's conclusions regarding $SO_2$ reductions caused by repowering are undermined further because it is unlikely that repowering technologies would achieve the cost-effectiveness vis-a-vis conventional technology that DOE reports.

According to EPA, the DOE study used "unrealistically high" cost engineering assumptions for conventional technologies.[5] The cost assumptions are also much higher than IGCI's own figures.[6] In addition, DOE assumes that under acid rain control legislation all units would have to install FGD systems and all would have to achieve a 1.2 lb./MM Btu emission rate. Although IGCI believes FGD systems would compete very well in the marketplace of $SO_2$ reduction options for utilities, it is not realistic to assume all units would retrofit them. Utility analyses have concluded that any $SO_2$ emission reduction scenario will produce a wide diversity in utility compliance strategies because of site-specific factors, the timing of the compliance decision, and institutional concerns.[7] Pending acid rain control proposals also allow some flexibility for states and individual utilities to average emissions and mix $SO_2$ reduction options.

In addition to these DOE assumptions which skew the comparative economics in favor of repowering technologies, it must be remembered that (as DOE acknowledges in its report) the cost estimates used for repowering technologies assume a series of R&D successes that have not yet been demonstrated, and assume that repowering equipment manufacturers are marketing standardized, factory-fabricated modules. Both these assumptions introduce much uncertainty, and DOE's cost-estimates for the repowering technologies should be further understood in this context.

Finally, we note that DOE's estimates of the need for new baseload electric generating capacity is crucial to its conclusions because only when capacity additions from repowering replace new baseload capacity do the repowering technologies approach economic competitiveness. The U.S. EPA, however, has criticized as "substantially overestimated" the additions to baseload capacity DOE estimates will occur, which EPA finds "extremely unlikely" in light of the actual, announced plans of utilities in the Northeast and Mid-Atlantic regions to meet anticipated peak capacity needs in the 1990's through a mix of more cost-effective approaches.[8]

Repowering technologies may eventually play a role in achieving the Nation's energy and environmental goals. But the limitations noted above in DOE's study show that critics of pending acid rain control bills must look elsewhere for convincing arguments.

IGCI prepared this analysis as part of its mission to assure a strong and workable national air quality policy that promotes public health, environmental quality, and industrial progress. As the primary representative of manufacturers of air pollution control systems and associated components, the Institute seek to evaluate and respond to regulatory and legislative initiatives and establish technical standards to the benefit of all citizens.

[1] U.S. Department of Energy, "The Role of Repowering in America's Power Generation Future," Office of Fossil Energy, November 1987.

[2] Id. at p. 36.

[3] Id.

[4] J. M. Campbell, Acting Assistant Administrator, U.S. Environmental Protection Agency, to J. A. Wampler, Assistant Secretary for Fossil Energy, U.S. Department of Energy, "Memorandum: Comments on the Repowering Report," December 22, 1987, pp. 5-6.

[5] Id. at pp. 1, 3.

[6] Industrial Gas Cleaning Institute, "Acid Rain Control Briefing Document on Retrofitting Flue Gas Desulfurizaton Systems to Existing Coal-Fired Boilers," July 1987, pp. 11-22.

[7] Electric Power Research Institute, "Coal Markets and Utilities' Compliance Decisions," EPRI P-5444, September 1987, P. 1-2.

[8] Supra, note 4, at pp. 4-5

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## INDUSTRIAL GAS CLEANING INSTITUTE SUPPORTS EPA FINDING THAT SCRUBBERS PRODUCE LESS WASTE THAN MANY CLEAN COAL TECHNOLOGIES

The U.S. Environmental Protection Agency (EPA) has correctly concluded that flue gas desulfurization (FGD) systems--sometimes referred to as "scrubbers"--produce a smaller volume of waste than many alternative technologies, according to the Industrial Gas Cleaning Institute, Inc. (IGCI). IGCI is the national association of stationary source air pollution control equipment manufacturers.

"As EPA correctly concluded, FGD systems are highly efficient and, as a result, produce less waste than many alternative technologies. For example, the total waste volume from a gypsum-producing FGD system would be only about 60 percent of the volume of waste solids a fluidized bed combustion system would produce," says Jeffrey C. Smith, IGCI's Executive Director.

"The additional FGD system waste is typically about the same or less than the ash any coal-fired plant will produce even without an FGD system, as EPA noted. In addition, mixing the FGD waste with the coal ash and lime can create a substance that is much easier to dispose of than the coal ash alone. Adding an FGD system does not therefore create a new waste disposal problem, and may actually help solve an existing one," Smith stated.

The EPA findings are from a June 9, 1987 letter from J. Craig Potter, EPA's Assistant Administrator for Air and Radiation, to Sen. John Warner (R-VA). Sen. Warner had expressed concern about sludge disposal.

IGCI noted that FGD systems are essentially of two types: dry and wet.

In a dry system an alkaline solution or slurry is atomized in the flue gas and evaporates to dry particles while reacting with the $SO_2$. The reaction products are collected, along with the coal ash, by a fabric filter or electrostatic precipitator, and disposed of as a dry powder waste material. There is no requirement for a sludge handling system.

In a wet system the $SO_2$-containing flue gas reacts with a shower of lime or limestone slurry drops, producing a slurry or "sludge." The reacted slurry can be oxidized and purified to produce gypsum, which can be easily landfilled or even sold commercially as wallboard. The latter case both relieves the boiler owner of a landfill problem and creates a potential source of revenue.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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JUN 9 1987

OFFICE OF
AIR AND RADIATION

Honorable John Warner
United States Senate
Washington, D.C. 20510

Dear Senator Warner:

Administrator Thomas has asked me to respond to your May 4, 1987 letter concerning acid rain control and sludge waste. While disposal of all wastes is of primary concern to the Agency, I will address issues relating to wastes produced by coal-fired plants.

I thank you for your interest and share your concern about large quantities of scrubber sludge which could result from use of control technologies to further a proposed 10-to-12 million ton annual reduction in sulfur dioxide emissions. I also appreciate your commitment to the Special Envoys commercial demonstration of control technology program which has been endorsed by the President. EPA is working with the Department of Energy, which has the lead in carrying out this program.

Coal-fired plants produce a large quantity of waste, even without the use of pollution-control devices. The utility industry has been able to dispose of this waste, as well as the additional waste produced by scrubbers already in place. Since scrubbers are highly efficient, they produce a smaller volume of waste than many alternative technologies.

EPA has calculated that about 70 million tons of coal ash and 15 million tons of scrubber sludge were produced in 1985. One base case projection found that, without changes in current law, 120 million tons of ash and 50 million tons of sludge will be produced annually in the year 2000. (Scrubber sludge production rises sharply because coal-fired units which are brought on-line in the interim will have to meet the more stringent New Source Performance Standards.) Using this base case, the Agency has estimated that, in the year 2000, S. 316 could result in an additional 10-to-14 million tons of scrubber sludge being produced while S. 321 could increase sludge production by as much as 37 million tons.

While flue-gas desulfurization (FGD) waste is not negligible, it produces less waste than many alternative technologies. For example, the total volume of waste from a gypsum-producing FGD scrubber would be only 60 percent of the volume of waste solids produced by a fluidized bed combustion system.

All coal-fired plants produce large quantities of coal ash(fly ash, bottom ash, and boiler slag) which must be disposed of in some manner. Many older plants which are limited by space necessitate off-site disposal of coal ash, and, in a number of cases, this operation requires trucking the ash several miles from the plant. The addition of a FGD system to an existing coal-fired power plant adds to the disposal problem but does not create a "new problem." The quantity of FGD waste generated fr m high sulfur coal is typically about the same or less than the quantity of ash produced.

For your information, I am enclosing a report done for EPA in 1985 on "Solid Waste Implications of Acid Rain Controls." The report examines solid waste generation under alternative acid rain control scenarios, reviews state regulations affecting electric utility solid waste disposal, and presents the results of an analysis of the constraints to siting disposal facilities, specifically at 50 coal-fired steam electric plants identified in Phase I of the Waxman/Sikorski bill, H.R. 3400.

Again, we thank you for your comments and appreciate your interest in our efforts to resolve environmental issues.

Sincerely,

J. Craig Potter

J. Craig Potter
Assistant Administrator for
Air and Radiation

Enclosure

ATTACHMENT 5

Industrial Gas Cleaning Institute, Inc.

**NEWS**

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RELEASE DATE:
January 15, 1988

## U. S. EPA DATA, CONCLUSIONS SHOW HIGH SCRUBBER REMOVAL EFFICIENCY AND RELIABILITY FOR INDUSTRIAL BOILERS

### *EPA Findings Announced With New 90% Sulfur Removal Rule for Industrial Boilers*

The U. S. Environmental Protection Agency (EPA) has concluded that flue gas desulfurization (FGD) systems (sometimes referred to as "scrubbers") for industrial boilers have averaged long-term reliability levels of 98-100 percent. Emissions data show sulfur dioxide ($SO_2$) removal efficiencies have averaged much greater than 90 percent.

EPA announced its research findings along with its establishment of new standards for industrial boilers that require a 90 percent reduction in $SO_2$ emissions. EPA has identified $SO_2$ as an air pollutant that causes severely adverse health and environmental effects.

Removal Efficiency. EPA concluded that 90 percent $SO_2$ removal was well-demonstrated by FGD systems, even when firing low sulfur fuels. EPA studied 45 sodium FGD systems -- currently the most widely used FGD systems on industrial boilers -- at 18 different sites. Both short- and long-term emission data for these installations showed consistent $SO_2$ removal efficiencies of greater than 90 percent, and averages much greater than 90 percent. EPA also noted that due to technical advancements, today's FGD systems are more efficient and reliable than in 1979 when EPA set corresponding requirements for new utility boilers.

Reliability. EPA's analysis of reliability data for over 250 sodium FGD systems operating on industrial boilers firing coal and oil revealed average long-term reliability levels of 98-100 percent. Other FGD systems also showed high reliability. EPA noted that data on dual alkali FGD systems showed over 97 percent reliability, and stated that commercial operating data on a lime spray dryer FGD showed greater than 98 percent reliability.

[more]

Waste Disposal. Based on its research, EPA also concluded that in most cases disposal of wastes generated by FGD systems presents no more of a problem than disposal of plant wastes or fly ash from steam generating units. As a result, FGD system wastes may generally be disposed of by the same means as these wastes. In fact, EPA concluded, "since the wastes from some industrial plants are considered toxic or hazardous, and FGD system wastes are not, disposal of wastes from FGD systems may present less of a problem than disposal of other plant wastes." 52 Fed. Reg. 47838 (col. 2). In any event, EPA stated, use of an FGD system does not generally create a new problem, i.e. a need to dispose of wastes where no such need existed before.

EPA published these findings in 52 Fed. Reg. 47826 (December 16, 1987).

The Industrial Gas Cleaning Institute, Inc. (IGCI) is the national association of stationary source air pollution control manufacturers. Its mission is to assure a strong and workable national air quality policy that promotes public health, environmental quality, and industrial progress.

For further information, contact Jeffrey C. Smith, Executive Director, IGCI, 1707 L Street, N.W., Suite 570, Washington, D.C. 20036. Phone: (202) 457-0911.

Mr. SHARP. Thank you very much, Mr. Feira.

We are going to recognize our colleagues here for 5 minutes each for questioning in our first round. Let me turn, Mr. Siegel, first to you and the Department and where you are headed. You are into round two now, as I understand it, considering applications on both repowering and retrofit. Is that correct?

Mr. SIEGEL. That is right.

Mr. SHARP. Let me express one of my concerns, and it keeps coming up through the panel; it is in one of our questions. My concern is this, that we don't know what Congress is going to require in the way of further emissions reductions. It has clearly been on the agenda, and there are many advocates for doing so, and it is certainly becoming a part of the presidential campaigns that have been going on for a year in this country.

My concern, especially being from an area where we could be hit with substantial costs, depending on what kind of acid rain program might be gotten, is how to, structure things if we get to that point that we are making decisions on this issue so that we can take advantage of the most efficient, least cost path to get further emissions reductions, and one of those possibilities, of course, is retrofit technology.

But my suspicion is that the Department has pretty well ruled out, at least in the early consideration of this, any focus on retrofit, and I guess I want to find out from you more about whether or not there is a real intent here to look at retrofit technologies. I mean this then goes to the question of timetables, which we are not going to focus on in any pollution control program. But I really would like to hear how you see this question of retrofit in this round.

Mr. SIEGEL. Sure. I think there is a misconception that the Department of Energy is interested only in repowering technologies and not retrofit. As a matter of fact, a good portion of our research budget deals with retrofit technologies. We have a very large flue gas cleanup program; very large programs in alternative fuels—there is a component of that that is retrofit oriented—advance combustors, which are retrofit technologies; coal preparation, which are retrofit technologies; and some others.

In round one of the clean coal——

Mr. SHARP. This is in the research budget?

Mr. SIEGEL. That is in the research program.

Round one of the Clean Coal Program, based upon guidance we received from Congress, was a very broad-based program seeking projects for all markets and all applications, and was really an energy-related solicitation. About half of the projects that we selected are retrofit technologies.

In round two, the focus of the clean coal demonstration program is retrofit and repowering, and as was mentioned before, two-thirds of the proposals that were received are retrofit technology proposals. So, clearly, I think that gives some real evidence of the fact that the solicitation was written to encourage retrofit proposals, as well as repowering proposals.

We think that both retrofit and repowering are very important technologies that need to be developed for the wide variety of market needs that exist. We place as much emphasis as we can on retrofit technologies.

Mr. SHARP. I think that is extremely important. I am not in opposition to repowering, because there is a lot of future there and a lot of power that is potentially involved in that kind of proposition, and I'm still struggling, as many people are, with how. We, first of all, have great difficulty because a lot is not known substantively about how these technologies will develop and how rapidly they will truly be available in the market for all purposes in the coal technology program. The hard part is to figure that out.

So we have difficulty struggling with that in terms of when people confront us with the acid rain program; and, second, difficulty politically figuring out what are salable kinds of timetables. Even though the debate hasn't advanced that very far in this Congress, some of us are trying to get ahead of it in the ball game and try to figure out where things are headed, if we can, in order to—to be honest with you—to shape that debate if and when it occurs, and I am a little concerned about coping out of that debate in advance.

Mr. Yeager, you did indicate that, obviously, if the Congress does, in fact—which you are not advocating—does, in fact, decide that it is going to insist on great $SO_2$ emission reductions, that in fact you could structure this so that you could take advantage of retrofit technologies—is that correct?

I realize again there are no definites here, but how much difference in a timetable are we talking about? Are we talking about a 5-year difference or 25-year difference? Can you give us any kind of ball park figures as to how long a stretch-out would make a true difference in terms of having some greater confidence that we could capitalize on more efficient technologies?

Mr. YEAGER. The maturity schedule for the various clean coal technologies, as we indicated, is in the latter half of the next decade. If you are then going to apply those widely as a compliance vehicle or whatever regulatory strategy is involved, you are talking about a time frame to design, fabricate, and install that over what may be 150,000 megawatts of capacity. The time frame from that is certainly one that is measured in years.

My conclusion is that anything that calls for compliance to the levels that have been proposed, like a 1.2 pound cap type of level, that is required in this century, before the year 2000, is largely going to exclude more than any marginal role for clean coal technology. I don't think it is 25 years later, I think it is probably during the first years of the following decade that really is when you could count on it being mature and broadly utilized and, again, not necessarily sweeping the market but filling its appropriate economically based role based on its success and commercial maturity.

Mr. SHARP. Mr. Disbrow, do you have a comment on that?

Mr. DISBROW. I think what Mr. Yeager said is true. I think, based upon our own experience with our own experimentation over the years, technological development of major proportion, we are looking at the best, our project, pressurized fluidized bed combustion, reaching commercial maturity in a time frame of 1997–1998, and that is on one demonstration plant, one repowering scale-up. If all works well, as we certainly hope it will, we then might be in a position to go forward on a commercial basis, truly commercial.

But if we were, the first installation could not be achieved much before the year 2002–2003.

Mr. SHARP. Do any of our other witnesses wish to comment on that proposition?

I am going to recognize my colleague from the State of New York, Mr. Lent, for questions.

Mr. LENT. Thank you, Mr. Chairman.

Mr. Siegel, the utilities argue that a deterrent to the deployment of clean coal technologies is the uncertainty over recovery of the costs of deployment from the ratepayers. Do you agree with this?

Mr. SIEGEL. Yes, sir, I do. Past decisions that have been made by public utility commissions that prohibited costs of certain investments to be passed through to consumers certainly are weighing heavily on risk-taking options that utilities may be considering.

Mr. LENT. You point out that utilities have spent $60 billion to reduce emissions. Doesn't this seem to indicate that utilities are willing to invest in clean coal controls and take their chances?

Mr. SIEGEL. Certainly utilities are willing to invest in air pollution controls, when they are required by State, Federal, or local requirements. That is true.

Mr. LENT. Does your Department, the Energy Department, support any kind of legislation requiring State commissions to allow utilities to recover their investment in clean coal technologies from the ratepayers?

Mr. SIEGEL. The Department of Energy and the administration generally do recognize the difficulties that utilities have right now with not being rewarded for risks that they take and being penalized for mistakes that they make that are normally associated with projects such as these. As a result, the President's Task Force on Regulatory Relief, chaired by the Vice President, did look at incentives and disincentives that do exist for the deployment of advanced technologies and made some recommendations. They made recommendations that dealt only with what the Federal Government can do to deal with problems.

We recognize that many utilities are regulated by State public utility commissions, but the administration also recognizes the concern over States' rights, and, as a result, the Innovative Control Technology Advisory Panel, an advisory panel directed to be set up by President Reagan to advise the Secretary of Energy on the Clean Coal Program, is conducting a study for the Secretary looking at possible actions the Federal Government can take to encourage States to adopt incentives.

Mr. LENT. Have you talked to any of the State commissioners?

Mr. SIEGEL. Yes.

Mr. LENT. And do any of them allow recovery of clean coal investment, that you know of?

Mr. SIEGEL. Ohio does.

Mr. LENT. We have a Governor in my home State who is a great proponent of acid rain controls, and a great supporter of clean air. He just entered into an agreement ordering the dismantling of a $6 billion nuclear powerplant out on Long Island not far from my district. When he was asked, "How are you going to replace the power that this nuclear plant would have yielded?" the answer was, "We're going to allow some coal-burning plants to be built on Long Island."

My question is, do you think that nuclear power has a role to play in reducing emissions from electric power generation?

Mr. SIEGEL. Yes, I agree with the administration's position that we need a balanced and mixed energy resource system. Certainly, nuclear energy does not produce any nitrogen oxides or sulfur dioxide, and to the extent that that technology is allowed to be used, it could play a role in reducing emissions as old, uncontrolled plants retire.

Mr. LENT. Given that Long Island is in a non-attainment area under the Clean Air Act, we would be allowed to build these plants.

Mr. SIEGEL. Coal-fired plants?

Mr. LENT. Yes, we would be allowed to build a coal-fired powerplant.

Mr. SIEGEL. It is difficult. There is certainly no doubt about that. Certainly, I would think it would be a lot easier to get approval for some of the advanced technologies once they are adequately demonstrated because of their inherently lower emissions than conventional technologies. But, as you point out, it is not an easy task.

Mr. LENT. But would it be possible under the existing Clean Air Act, and the proposals we are working on in Congress to amend that Act, to build anything that is going to emit as much $NO_x$ as a coal-burning facility? Before it could be constructed, offsets would have to be obtained, would they not?

Mr. SIEGEL. That is right; yes, sir.

Mr. LENT. That would mean closing down some other facilities that burn fossil fuels that emit $NO_x$.

Mr. SIEGEL. That is right, sir.

Mr. LENT. I wonder how many hospitals, schools, dry-cleaning facilities, bakeries we are going to have to close down on Long Island before we can build one of these coal-burning facilities to replace the Shoreham nuclear plant.

Mr. SIEGEL. I would expect that in New York City you would have to prohibit people from utilizing their automobiles.

Mr. LENT. I don't think that story has been told on Long Island, but it will be interesting. Thank you.

I have no further questions, Mr. Chairman.

Mr. SHARP. I understand the gentleman wants a witness from the Yellow Cab Company.

Let me ask my colleague from Ohio, Mr. Regula, if he has some questions for our witnesses.

Mr. REGULA. Thank you, Mr. Chairman. Again, I appreciate your courtesy.

Mr. Feira, I would like to clarify that in your testimony you were indicating that gas would be an alternative in terms of emission control.

Mr. FEIRA. What would be? I'm sorry.

Mr. REGULA. Did you state that gas, natural gas, would be a possible boiler fuel?

Mr. FEIRA. No, I did not.

Mr. REGULA. I thought the thrust of what you were saying was that industrial gas is a possibility.

Mr. FEIRA. No, no. Our industry, the Industrial Gas Cleaning Institute, supplies precipitators, scrubbers. We are not involved in natural gas at all.

Mr. REGULA. You are not.

Mr. FEIRA. All the equipment we supply is for fossil-fired powerplants.

Mr. REGULA. So the thrust of your testimony is that these devices would address the problem. Is that correct?

Mr. FEIRA. Yes. The thrust of the testimony is that the devices are available, have been used for a number of years, and are proven reliable devices.

Mr. REGULA. And you are saying that this is preferable to waiting on the clean coal technology.

Mr. FEIRA. Yes, I think that is really the issue.

Mr. REGULA. I don't think you mentioned what to do with the sludge by-product, or do you have a different type of by-product?

Mr. FEIRA. It depends on what type of scrubber you are using. As I said, there are 144 scrubbers currently in operation on utility powerplants, and the sludge is disposed of in satisfactory manners.

Some of the latest technology involves dry scrubbers, which does not produce a sludge but just produces dry ash and is disposed of in the same manner as precipitator ash or bottom ash in the boiler.

Mr. REGULA. Mr. Disbrow, you are president and CEO of AEP. What is your experience with a grid? Is there a lot of movement of electricity around the country through the use of the interlock? In terms of rate costs, would the consumer in the Northeast or California actually be substantially impacted by the decision that is made on the way in which we address the problem of emissions?

Mr. DISBROW. Yes, sir, that would be very true. In fact, I can give you a live illustration. We are going to bring a new coal-fired station in near Evansville, Indiana, next year, and several eastern utilities are seeking part of the output of that unit, but they want an escape clause in the event that we have to retrofit that unit, which has been grandfathered under the Clean Air Act, with a flue gas desulfurization retrofit. They would like then to have that ability to void the contract if that should happen.

Mr. REGULA. If I understand you correctly——

Mr. DISBROW. They like the price without the scrubber; they won't tolerate it with.

Mr. REGULA. I think that says it eloquently. Thank you, Mr. Chairman.

Mr. SHARP. The gentleman from Florida, Mr. Bilirakis.

Mr. BILIRAKIS. Thank you, Mr. Chairman, and, again, sir, if I may, I would like to thank you for your diligence on this issue. This is the fourth hearing. Mr. Feira, do scrubbers have the disadvantage of reducing the productivity of powerplants?

Mr. FEIRA. It depends. Obviously, unless a scrubber is 100 percent available, the addition of a scrubber would reduce the productivity of a powerplant. Also, the scrubber requires electricity to operate, so it consumes some of the output of the powerplant. It is not free; I mean there is a cost associated with the scrubber.

Mr. BILIRAKIS. We are assuming that they would be 100 percent available. But what you are saying is that the additional power that would be required to put that into effect would then reduce the output.

Mr. FEIRA. It reduces the net output of the powerplant, yes.

Mr. BILIRAKIS. But only in that sense would you say it reduces the productivity?

Mr. FEIRA. Well, it would reduce it in the instances in which it is not 100 percent available. Most of the National Electric Reliability Council data indicates that most scrubbers are in the high 90 percent availability ranges now.

Mr. BILIRAKIS. What do you mean by "available"?

Mr. FEIRA. The percentage of the time that they are available for use compared to the percentage of the time their use is required. Most scrubber installations will have a spare module, for example, a maintenance module, so that if one module fails——

Mr. BILIRAKIS. You are talking about downtime.

Mr. FEIRA. Right.

Mr. BILIRAKIS. That is something that can be worked out. That is a concern from a technical standpoint regarding any piece of equipment.

Mr. FEIRA. Oh, any piece of equipment on a powerplant or any other powerplant has some amount of downtime.

Mr. BILIRAKIS. This may have been addressed by you, gentlemen, but I guess I would ask you, sir, how much is the private sector contributing in terms of research to clean coal technology?

Mr. FEIRA. My company is personally not involved in that, so I'm not sure I'm qualified to answer that. I suspect one of the other gentlemen is better qualified.

Mr. BILIRAKIS. Mr. Disbrow?

Mr. DISBROW. I think Mr. Yeager might have the figures for the entire industry, but our company has two projects, and we have received a third on the first project, and we are seeking a third on the second project.

Mr. BILIRAKIS. All right. But somebody testified earlier—it may have been Mr. Yeager—in response to a query about when would this be ready to go on line, and I think he said the late 1990's. Is that correct? Can't we work faster than that?

Mr. DISBROW. In my opinion, no. The reason is, let's take our own technology, the one that we are trying to develop, pressurized fluidized bed combustion. The demonstration plan will not be operative until 1990–1991. Now in order for us to parallel that activity with another one, we have no benefit of operational feedback in the demonstration plant, which is important in terms of the design of the subsequent unit.

So the fastest we could have the next unit in, which is DOE–2, would be 1995 or 1996, and we would need 1 or 2 years of evaluation and operational result before we could further revise and refine the technology to the point that it could be warranted by manufacturers that we would be assured that it would be used and could be used wide-scale. If you rush technology to the market, you may well wind up with a host of powerplants that simply won't operate.

Mr. BILIRAKIS. Yes, but we are faced with the alternative of rushing emission control reductions into the market, are we not?

Mr. Disbrow. Again, from my point of view, there is no scientific evidence of that need to rush into this thing.

Mr. Bilirakis. That is the big argument.

Mr. Disbrow. The other problem is the trade-off between the acid rain issue and the economy, which I think is very important, particularly in the Midwest.

Mr. Bilirakis. In your view, did we get started as soon as we should have regarding this new technology?

Mr. Disbrow. We never start anything as soon as we should have, sir, but we started our program back in 1976, which predates the emergence of the clean coal technology program, the Drew Lewis findings, and so on.

Mr. Bilirakis. When did you start it?

Mr. Disbrow. In 1976, and we are just getting to the point where we feel comfortable enough with the technology to build a demonstration facility.

Mr. Bilirakis. It has taken 12 years to get to this point?

Mr. Disbrow. Electric utility technology, sir, takes a long time to develop. Folks have a difficult time understanding that, but when we developed our supercritical steam cycle polarized coal, we started in the latter 1950's. The first truly superior model went on line in 1971. That was 22 years later.

Mr. Bilirakis. Certainly the clean coal technology program is of great benefit to the coal industry. Has the coal industry done its share in terms of timely attention to this program and the research required? I would ask whomever—I guess Mr. Siegel, whoever is appropriate there.

Mr. Siegel. The coal industry, the coal producers are providing some resources and coal, for example, to the program.

Mr. Bilirakis. They are providing the coal?

Mr. Siegel. In some cases, to some of the projects, and that is a considerable amount of money if one turns that coal into cash.

Mr. Bilirakis. The stakes are pretty high.

Mr. Siegel. The stakes are pretty high. And coal companies, by and large, are going through some difficult financial times. Most of the money that is being spent on new technology is coming from utilities, boiler manufacturers, turbine manufacturers, people who have quite a bit to gain through the demonstration and ultimate deployment of these technologies.

Mr. Bilirakis. And I am not trying to throw stones at the coal industry, I certainly don't mean to do that, and I know that they are going through some pretty hard times, but I also know that the stakes are pretty darn high for everybody, but certainly for the coal industry. I'm just wondering if they have addressed the problem adequately enough.

Is the industry, in general, reacting now to these calls for acid rain legislation?

Mr. Yeager. I would like to underscore that it is certainly the latter. It has been a proactive effort. In fact, it far predates the concern on acid rain. It has been driven by the need for more productive uses of coal across the board, beginning in the early 1970's, when not only environmental issues but coal quality issues, productivity issues of a wide range began to affect the industry, and the fact that we have a technology program today which you gentlemen and the Nation can consider is due to the investment that has been made by the private sector in getting that range of technologies to the point where we can begin to seriously consider them.

Just underscoring the point that Mr. Disbrow made, one of the things that I think is perhaps most difficult to understand—and those of you gentlemen who have visited powerplants probably can appreciate the point I am going to make—is the sheer scale, the sheer size, of an installation that we are talking about. The scale-up of a technology from its inception, which may be in a laboratory, to a 1,000-megawatt powerplant goes up through a level of scale that may involve five steps along that line. It may fail at any one of those steps on performance or reliability grounds. Its clear costs are not understood with any kind of confidence until it gets to probably the third or fourth step of those five, and that is about where we are today with most of these clean coal technologies. The first three steps, at least, have been carried by the private sector.

We are getting to the point now where we are looking at what I would call a national joint venture to move these technologies aggressively and accelerate them as quickly as possible to the point then when the private sector can implement the fifth step as a market choice.

Mr. BILIRAKIS. But the trouble is, sir, you are talking about the third step of five and we are really in the top step of having to make decisions here in the Congress regarding acid rain legislation. We don't have the benefit or the luxury of saying, "Hey, this is just the third step, and let's just pass this step; we know four and five are coming up, and we would be able to take what is happening at that point in time, whatever the technology advances have been, into consideration."

Let me ask you this. You made the comment that clean coal technology is an alternative or an option that we gentlemen and ladies up here are taking into consideration. I submit to you, I'm not sure that we are. The acid rain legislation, as you know, which has been contemplated has blinders and is just really one way, and that is emission control, scrubbers, et cetera.

Should our legislation consider things such as nuclear licensing reform? Should it consider things such as our previous hearing of energy conservation? Should it consider, obviously, clean coal technology programs? Should not the entire committee and the entire Congress take a look at the broad picture of other alternatives?

Should our legislation be considering all these areas in terms of reducing acid rain? I suppose you all would say yes. I guess most any intelligent person would say yes.

Mr. DISBROW. Clearly, the answer is yes. But I would hasten to add, Mr. Lent's experience on Long Island and some other experiences elsewhere, we can revise all we want nuclear licensing, but as a utility manager I would not long have my job if I went to our board and suggested we build a nuclear powerplant unless the Congress can change public perception of nuclear power.

Mr. BILIRAKIS. That is why I phrased my question, nuclear licensing reform.

Mr. DISBROW. I think it is important for the future, but in terms of something imminent, unless it deals with a plant coming to the commercial phase. But in terms of encouraging new nuclear initiatives, in terms of new plant commitments, I doubt it would do much for that.

In terms of conservation, it is very difficult to really evaluate or make sure that you are going to get anything substantive, and to promise yourself you are going to conserve yourself into prosperity, it may be very comforting today, but in 5 years when you turn around, you might find that the American people didn't agree with you.

We have had several programs directed at conservation. I think the Congress suggested—I'm not sure if it was in PERPA or wherever else—that we should offer energy audits, and we were admonished after we offered the energy audits and nobody responded to reoffer energy audits.

With some exceptions, one-quarter of 1 percent of our customer base asked for energy audits. You cannot force the American consumer to conserve unless the American consumer wants to conserve, and the best ingredient for conservation is the pocketbook. There was a lot of pocketbook conservation after the oil embargo and the upward sweep of energy prices. That now seems to be diminished to an extent. So I'm not sure you can legislate conservation, is the answer.

Mr. BILIRAKIS. I know my time is probably up, Mr. Chairman, and you are being very kind, but I would just ask one question and maybe get responses for the record, if I may, sir.

Mr. SHARP. Certainly.

Mr. BILIRAKIS. Retrofit technologies as well as the repowering, the information that I receive is that retrofit technologies, which are relatively simple and inexpensive, can reduce emissions by 40 to 70 percent, and then repowering, which, of course, involves conversion or replacement of the utility boiler, can achieve a 90 percent reduction in emissions. Are those figures correct? Number one, and, number two, what are the costs insofar as those figures are concerned? Whomever it might be appropriate to, would you submit that information to us for the record?

Mr. DISBROW. We would be delighted to.

Mr. BILIRAKIS. And as soon as possible so that we can, in fact, take those blinders off and consider all of these alternative means to reduce acid rain.

Mr. DISBROW. I believe much of that is already appended to my written statement that is filed with you.

Mr. BILIRAKIS. OK. I haven't had the benefit of reading that.

Mr. DISBROW. We will flesh that out and send it in.

Mr. BILIRAKIS. Would you flesh that out and send it? Thank you. Thank you a lot, Mr. Chairman.

Mr. SHARP. I thank the gentleman.

The gentleman from Washington, Mr. Swift, is recognized.

Mr. SWIFT. I thank the chairman.

Some of us have been trying to figure out ways to see if we can't resolve some of the legitimate differences of opinion which have essentially brought to a halt any action on acid rain legislation by the Congress. I realize this panel is on clean coal technology, and I support that, and I would hope that we could fashion some kind of a program that would not lead to Mr. Siegel's conclusion that if you do it you are going to essentially force everybody into scrubbers and there wouldn't be any need for clean coal technology.

I would like to pursue some kind of a phase-in where that dilemma would not be created. Whether we can do that or not remains to be seen, but I would like to take advantage of Mr. Feira here, who is an expert on scrubbers, and ask him a question that might shed some light on something that we have been thinking about a little bit.

Two Congresses ago, there was a bill called H.R. 3400, and one of the mechanisms it used was to mandate the installation of scrubbers on the 50 highest emitting powerplants, do that immediately, right up front, and have it paid for essentially—up to 90 percent, I think—by the Government.

One of the criticisms of that—there were a number, of course, but one of them was that the industry couldn't manufacture 50 plants in that kind of a timeframe. So I would like to explore with you what the industry's capacity is today. Would 50 still be unrealistic in terms of what the industry's capacity would be, and, if it is, what would the industry's capacity be, realistically?

Mr. Feira. It depends on the timeframe you are talking about. If you passed legislation tomorrow that said within 3 years 50 scrubbers had to be on line, that would be a problem, obviously. But certainly with any realistic type of timeframe it is not a problem, and the reason it is not a problem is that primarily very few of our members have fabrication/manufacturing facilities. We utilize fabrication plants around the country. The reason we do this is simply that the industry is too cyclical to have our own fabrication facilities.

Mr. Swift. Sure.

Mr. Feira. So the only roadblock, really—the constraint is in our process design people in house, and I think we feel we have enough people to respond to that.

You can look at the example in Germany where, in 1983, they passed legislation to require all plants to have scrubbers installed. They have installed something like 110 scrubbers in 5 years over there with about 6 suppliers. There are a lot more than six suppliers here in the United States.

Mr. Swift. You said that you couldn't do 50 in 3 years but you could in a realistic timeframe. What would you say that would be?

Mr. Feira. I would think 5 years would probably be realistic.

Mr. Swift. What would be the capacity, say, if you had 3 years? What I would presume is that at the very front it would be relatively slow, but as you geared up you would be able to do some faster.

Mr. Feira. Yes. Again, the problem—and I can't tell you precisely whether it is 40 or 38, but I think we could do the majority—you could do at least half perhaps in 3 years, and, frankly, I'm guessing a little bit there but could get precise numbers from people in our company.

Mr. Swift. But we wouldn't be wildly crazy if we said 25 in 3 years.

Mr. Feira. Not at all. Germany did 110 in 5 years with only 6 companies, essentially, supplying the scrubbers.

Mr. Schwartz. Mr. Swift, I wonder if I might comment on that.

Mr. Swift. Yes, certainly, Mr. Schwartz.

Mr. Schwartz. You shouldn't forget that the laws of supply and demand are going to work. You are going to tell people that they need the scrubbers, and the supply is going to come up to provide them, but the cost is going to go up substantially. When you tell an industry with limited capacity that you can sell everything you can produce, just name the price, it is going to cost a lot of money.

The German experience is a lot of numbers of scrubbers but not nearly as many megawatts, is what you are talking about. So I mean there is an analogy there, but it is not quite 110 versus 50; it is more like a lot fewer megawatts versus double the megawatts.

So the answer is, it is going to cost a lot of money. Anything can be done if you throw money at it, but it is going to cost a lot of money and there are going to be a lot of cost overruns and a lot of delays.

Mr. Swift. Let's explore that. This is going to cost a lot of money no matter what we do.

Mr. Schwartz. That's right.

Mr. Swift. You are saying it is going to cost somewhat more, and I understand what you are saying. I think it makes sense that if you have a large, almost instantaneous demand, there are going to be some real cost additions, plus you are suggesting that maybe that will get loaded just a little bit here and there around the edges. OK.

So if we are exploring something like this, you are suggesting we should take into consideration that the larger the demand we create, on some kind of a basis you would be driving the cost per unit up somewhat, so that how long a period of time we consider would be a factor, how many plants would be a factor, and those would interrelate in some fashion on the cost out at the end.

Mr. Schwartz. That is correct.

Mr. Swift. Mr. Disbrow.

Mr. Disbrow. An additional factor is whether retrofitting with a flue gas desulfurization system is even practical at a given plant site. They do take an enormous amount of room, and many of the older powerplant sites were never purchased with that in mind.

Mr. Swift. What we have been kind of tossing around is to try and determine what would be, whatever the number is, the most cost-effective ones, so the idea would not be to take a plant that is going to not be very cost-effective and force it but, rather, in order to get some real, up-front, fast impact would be to try and select a number of plants and fund them directly so you could get into it and try to pick the ones where that would make the most sense. That is at least the theory that we are playing with.

Any other comments on that approach at all?

Yes, Mr. Yeager.

Mr. Yeager. I would express concern about it, and not to turn this into a scrubber bashing meeting, because I don't think that clean coal is intended to do that. In fact, I view scrubbers as an important element of clean coal. In fact, the lessons learned from the development of scrubbers is, to a large extent, what has driven the program we now know as Innovative Clean Coal Technology, where we imposed by administrative fiat a specific technology to be applied without consideration to cost, reliability, or other issues into an industry and created a tremendous amount of ill will in the process, probably made a lot of lawyers very rich, but didn't do an awful lot for clean air for quite a while.

We are now beginning to climb out from under that very expensive lesson, and I would certainly, as a taxpayer, quite apart from my involvement otherwise, find that such an approach of subsidizing that kind of level of involvement on a retrofit program to really be not in the best public interests.

Mr. SWIFT. Do you have any problem with subsidies for clean coal?

Mr. YEAGER. In a measured way for the development of those, no, but for their commercial installation and so forth I think one ought to think very carefully about that, given our national economic status these days.

Mr. SWIFT. I understand what you are saying, and I think we have to take those things into consideration, but what we are trying to deal with here is that, as you deal with this very difficult problem of acid rain, the political pressure in Congress to do something is mounting.

Some of us think Congress will do something soon, whether it knows how to do it or not. So it behooves us to stop figuring out all of the things we can't do and start figuring out what we can do.

I understand the cautions that you make. I think they are wise. We need to consider them. But we have got to start figuring out what we can do, because otherwise we are going to arrive at a point where there is going to be this enormous ardor on the part of Congress to love this issue and they won't know quite how to go about it. I don't think I'll follow that analogy anywhere and yield back the balance of my time.

Mr. SHARP. Mr. Schwartz, I want to give my colleague from Pennsylvania, Mr. Walgren, a chance. We are going to leave to vote in about 5 minutes, and I want to give him a chance to ask questions, if he does, and we may take a break and come back for more questions. But I would like to let him have a chance.

Mr. WALGREN. I think I can be relatively brief, Mr. Chairman.

The question that I have is how are these new clean coal technologies coming along in advance of the dates that we anticipated in these acid rain control measures. In times past, it has been my understanding that we were told that we could expect a certain number, even a suite, if that is the right word, of technologies that would be available before 1993. They talked of a window of opportunity, and now, apparently, we don't talk so much of a window of opportunity. I wanted to ask Mr. Siegel whether we can anticipate real choices being available to us before 1993.

Mr. SIEGEL. Mr. Walgren, I guess the answer to that is that we certainly will have a number, even a suite, of technologies that will have been demonstrated in the early to mid 1990's.

Under our first Clean Coal Program, there are a number and variety of technologies, whose time lines call for the completion of the demonstration before 1995, in the 1993 to 1995 time frame. Whether or not that one demonstration of that particular technology, the suite of technologies, gives enough confidence to the ultimate user of the technology in commercial applications that it is reliable technology is really the issue at hand.

My sense is, having talked with many people in the utility industry, that because of the current regulatory climate and because of the good and valid reasons that utilities are risk averse these days, only one demonstration of a particular technology might not give them the confidence they need to immediately go out and make commitments to build many of these technologies at their units.

Mr. WALGREN. Would the requirements for performance by an early date make them more willing to move forward and make a commitment to a technology that may have only been demonstrated under limited circumstances?

Mr. SIEGEL. I wouldn't think so. We do have a utility executive here who might want to respond to that from his perspective, but my sense is that by forcing compliance in the early to late 1990's is not going to be the driver that is going to encourage people to use these advanced technologies. In fact, it will very likely be just the opposite. People will go with the tried and true technology.

Mr. WALGREN. In a limited time, does someone else want to comment on that?

Mr. DISBROW. Yes, I would agree with Mr. Siegel. You have just made Mr. Feira a happy man, because if we have to meet near-term compliance dates, we will have to go with a proven technology; we simply cannot risk immature technology at this point. We are held to account on availability and reliability of power supply, and I can give you an illustration from the State of Ohio—not a great deal of money—in a way it is—of a $6 million research project we undertook to further deep clean Ohio coal. It did not work; we did not get recovery. They ruled that it was an R&D program that did not work, so there was no recovery for us. Clearly, we will risk hundreds of millions of dollars on that basis.

Mr. WALGREN. Thank you, Mr. Chairman.

Mr. SHARP. I am afraid we are going to have to go vote; we are down to the last 5 minutes.

Gentlemen, Congressman Jim Cooper, who has a proposal on acid rain, as a matter of fact, is on his way back from voting to ask a few more questions. So I hope there will be a break of just about 5 minutes, and he is going to have about 5 or 10 minutes of questions, and then we will bring it to a close. So if you will bear with us, we will recess for a few minutes.

[Brief recess.]

Mr. COOPER [presiding]. If the witnesses could return to the witness table, the hearing will resume.

I appreciate most of the witnesses returning to the table; you get an A for attendance here. I just want to ask a couple of questions, and I will try to be very brief.

Assuming that this Congress is interested in passing an acid rain bill—and I realize that is a big assumption—it seems to me that the timing of significant emissions reductions cannot be before the latter half of the next decade—in other words, cannot be before 1995–1996—if clean coal technology is to have a serious chance of playing a role in that, because I think Mr. Disbrow testified earlier that by the time we get to a proven commercial size clean coal technology plant it will be at least that long. Would you say that is a consensus view among the panelists here today? Would that be a fair statement, Mr. Yeager?

Mr. Yeager. I will just speak for myself; others can do it independently. But I think if you are going to look at it in terms of a substantial contribution to emission reduction, given the time frame after demonstration, that you are really looking at at least the year 2000, not 1995. Anything in 1995, I think, is, by definition, going to leave clean coal in a marginal situation.

Mr. Cooper. I was looking at a number that would be a consensus number. I understand that you, representing the Electric Power Research Institute, would probably have a tendency to err toward delaying it, as opposed to moving it forward. To me, that would be a relatively fair assumption.

Would any other panelist care to comment on that?

Mr. Schwartz.

Mr. Schwartz. I think the way he stated it is reasonable; I would agree.

Mr. Feira. I would also agree with that.

Mr. Cooper. To me, what I said is almost common knowledge. One of the surprising things, I think, that this hearing has informed the members of is the fact that—Mr. Feira's statement—that before you could get substantial scrubber capacity it would take 5 or so years, and that means, really, you are talking the latter half of the 1990's if you want substantial scrubber capacity.

Mr. Feira.

Mr. Feira. Let me correct that statement. I think that from the time legislation was passed until the time scrubbers could be implemented would be about 3 years. I mean by the time the utilities do the basic engineering, write the inquiry documents, select a vendor, design the equipment, erect the equipment, it is probably 3 years, and you couldn't, on day one, pass legislation to retrofit every single plant out there within 3 years; there would have to be some timing. So I think the first ones would come on line in about 3 years. Within 5 or 6 years, you could have them all retrofitted.

Mr. Cooper. Mr. Yeager.

Mr. Yeager. With that correction, having been in the scrubber business also for some 20 years, maybe the first one in 3 years. But if you are talking about the level of capacity that is being talked about there, no matter what you do, your bottom line conclusion, I think, is the correct one. There is no way to get there from here before the latter part of the 1990's, and even then the solutions that were available in that time would be a rather expensive one environmentally, let alone economically.

Mr. Cooper. Just so that it is crystal clear, let me restate it. Whether you choose scrubbers or clean coal technology, you are going to have to wait until the later 1990's if you are interested in serious emissions reduction of those chemicals that cause acid rain, $SO_2$ and $NO_x$.

Mr. Schwartz. Part of the difference in what you are hearing is the statement of when will the first reductions be achieved versus the final implementation date. If you are talking about a final implementation date of less than 5 years, you are principally talking about fuel switching with some scrubbing, and if you make it more like 7 years then you have the opportunity to get a lot of scrubbing if it is economical.

Mr. COOPER. I understand that. I think that many of my colleagues, however, have the mistaken impression that scrubber technology is instantly available, it is off-the-shelf, and can be put in place almost overnight. That is kind of a cartoon, simplistic view that I think is widely believed by a number of my colleagues. So to me that is a fundamental point that we are going to have to wait a little while before either type technology, scrubbers or clean coal, is going to really be ready to do the job.

Mr. FEIRA. That is correct, but there is a lot longer wait for clean coal technologies. I don't think there is any question about that.

Mr. COOPER. To me, that is not necessarily apparent from the testimony. I realize that you could implement some scrubbers almost immediately, but if you are talking about serious reduction, widespread use of scrubbers, as Mr. Schwartz was pointing out, the megawatt capacity of our country is so much greater than Germany, and you are talking about either paying exorbitant prices for immediate scrubbers or waiting a reasonable period of time, a couple of years, before we can get scrubber capacity up to the point where serious emissions reductions could be achieved.

To me, Mr. Feira may be having a tendency now to promote the off-the-shelf, instantly available view as opposed to, in my opinion, the more realistic view that is going to take years before most plants in the country could be outfitted with serious scrubbers.

Mr. SCHWARTZ. To just back Mr. Feira a little bit, there is a difference, though, between—I'm saying no matter what the technology is between the time it is available and the time it is implemented on 150,000 megawatts takes maybe a 5- or 7-year period. What he is saying is that you don't have to wait to get started construction on scrubbers now, because they are here now, and what you are hearing is that on a number of clean coal technologies they are not commercial now, and so there is some difference in time.

Mr. COOPER. Mr. Disbrow.

Mr. DISBROW. Even if we assume that the scrubber is available, which it is, and could be deployed somewhat earlier than the clean coal technologies we are now demonstrating through Clean Coal I and Clean Coal II's of DOE's, scrubbers are not going to attack the $NO_x$ problem. Many of the clean coal technologies will attack $NO_x$ as well as $SO_2$. I think it is worth waiting for that. If we employ scrubbers for just $SO_2$ emission and then have to go back and deal with $NO_x$, we are just going to be double dipping in terms of the financial burdens.

Mr. COOPER. I'm glad you brought that point out, because to me not only is that a crucial difference between scrubbers versus clean coal technology; there are a number of other fundamental differences between the two technologies that have led me to conclude—and I'll be open in stating my preference—clean coal technology is much the better way to go if you are looking at a long-term economic solution to the problem. Scrubbers are a temporary, generally retrofit approach that can achieve a quick fix, but they are not as good a solution as clean coal technology.

I don't want to make Mr. Feira too upset here, but would you say that, in general, you panelists would also have a general tendency to prefer clean coal technology as opposed to scrubbers? I see Mr. Siegel nodding.

Mr. Disbrow. Speaking only for myself, I think we should have the availability of all the options; I don't think we should foreclose any.

Mr. Cooper. I have a strong selfish motive in mentioning a number of these because, as many of you might know, I have introduced a bill, H.R. 4331, that is designed with a late timetable to give you at least until 1996 before serious reductions would be expected and to allow utilities complete freedom of choice as to how to achieve the initial reductions, so that we as a Congress would not be mandating scrubbers or fuel switching or clean coal technology, at least in the early years; you would have complete freedom of choice as a way to do that. So I feel very close to a number of the views I have heard expressed here today.

Mr. Feira. And our views are not inconsistent with that. I testified earlier that we did not favor a forced scrubber bill; we favor allowing the utilities to achieve the required reductions in whatever manner they want.

Mr. Cooper. But, nonetheless, a number of Congressmen have been promoting scrubbers using a forced scrubber approach, which I think is a mistaken view, but it is, nonetheless, a view that would help you sell scrubbers, and we have to guard against that.

Mr. Disbrow.

Mr. Disbrow. Unfortunately, the major technologies that are available today are scrubbers, and if we had to meet a 1996 timetable, if we were to abandon our efforts on clean coal technology and move right to scrubbers because they are proven, we could not take the risk. By 1996, you will have the second replication of our particular choice for the future, but we certainly would not go forward with four or five units at that time; the risk would simply be too great.

Mr. Cooper. I understand that, but, to me, no particular year is going to be satisfactory with everyone, and the 1996 time deadline is certainly preferable to a 1990 or 1991 deadline. That is what we are trying to work on, to get Congressmen thinking in a more realistic way about the time and trouble that it takes to seriously reduce emissions.

Mr. Disbrow. I would agree that 1996 affords an opportunity to do this thing on a conscious and practical basis, but I don't think 1990 or 1996 really is going to change greatly the options that are available to us.

Mr. Cooper. Mr. Yeager.

Mr. Yeager. I think that one of the other important distinctions that I see, looking in your proposed legislation and others as they move forward, is a phasing approach, so that you are looking at the opportunities to achieve it in steps rather than all in one amount. That also, I think, has some merit to it.

Mr. Disbrow. Mr. Cooper, could I ask a question which has been troubling to me? The Congress has already spent over $300 million on NAPAP. Now that report won't be finalized until, I think, the end of 1990. Why is the Congress impatient, having spent $300 million, to not wait the next several years before deciding whether this kind of a program is indeed even necessary?

Mr. Cooper. Well, if you would like to wait until President Dukakis is in the White House and Senator Mitchell is Majority Leader, you are welcome to wait. To me, that would be a very unwise move on the part of your utility or most other utilities. Politics is a curious business. You have to do what is possible at the time, and sometimes it is important to see the handwriting on the wall. The NAPAP preliminary results were shocking enough for most people to conclude that there is a serious problem.

A recent EPRI witness concluded that, as environmental insurance, serious reduction of emissions of $SO_2$ and $NO_x$ would be a prudent measure right now. This is an EPRI researcher speaking.

To me, the evidence might not be proof beyond a reasonable doubt right now, but it is getting closer, and, to me, it is a situation in which a number of folks, environmentalists included, need to be looking for a compromise, looking for a solution, so that we don't have the "all or nothing" approach, and so far it has been from industry, do nothing, environmentalists, do everything, and, to me, those options are not workable. To me, we need a middle-of-the-road solution that gives us clean air at an affordable price.

Mr. DISBROW. I disagree that industry has been doing nothing. Our firm alone has committed the better part of three-quarters of a billion dollars to clean coal development.

Mr. COOPER. I didn't mean that industry was doing nothing, that we as Congressmen are asked by industry to do nothing when our constituents in an election year say, "What did you do to clean up the air?" and we say, "We stonewalled legislation the last few years." That puts a number of members in a very difficult situation.

Mr. Yeager.

Mr. YEAGER. Mr. Sharp, having referenced an earlier EPRI testifier, which I presume was Dr. Hidy——

Mr. COOPER. I think we had better correct this. I am Mr. Cooper. I don't want to get Mr. Sharp in trouble for any of these statements.

Mr. YEAGER. I am referring to Mr. Hidy, from his testimony. I believe what he said was that we enjoy the opportunity for a prudently planned program of reduction, not an instant program of reduction, and I think that is not inconsistent with what is going on and where we would hope the Nation would put its priorities in the future.

Mr. COOPER. Mr. Siegel.

Mr. SIEGEL. Yes, sir. I would like to just add one more piece to this discussion, and that is something that I have said in my testimony and others have as well. $SO_2$ emissions are declining, continue to be declining, and all projections show that $SO_2$ emissions will continue to decline dramatically into the future just under current market forces. So there is another element to the discussions.

Mr. COOPER. I am quite well aware of that, and if we wait long enough all the plants will be sold, they won't be producing anyway, so we won't have to worry about it. It is a question of how long you want to wait, and I just worry that if the utility industry is intransigent much longer that you could end up with a Mitchell-type bill, and that would be, I think, very harmful for a lot of folks. So that is my concern, that we would be forced to go to one extreme when, in my opinion, we need to be looking for some middle ground.

It worries me, the extent to which a decision to make even preliminary emissions reductions right now would mandate scrubbers, and that would, in turn, preclude serious investment or interest in clean coal technology. To me, that linkage is a very unfortunate and destructive process, and I am looking for a way to kind of cut that linkage, because, to me, it is a shame when a relatively small initial legislative step ends up having technological consequences 20–30 years out that are inefficient, sometimes counterproductive. Can you gentlemen suggest any way that we could delink those decisions?

Mr. Disbrow. It is a question of time, because the newer technologies that we are discussing in Clean Coal I and Clean Coal II are simply going to have to mature. You cannot risk going forward with an immature technology.

Mr. Cooper. If it is a question of time, would you be willing to agree to a year 2000 date today? If you don't like 1996, is 2000 long enough, or are you going to want to wait until 1999 until you tell me whether 2000 is enough?

Mr. Disbrow. To get full-scale commercial deployment by the year 2000 of a new technology that is in the demonstration phase today simply isn't going to happen. We will be beyond 2000 before we get wide-scale implementation of these new technologies.

But if we look at the record, we are going to need within the next 20 years 250,000 megawatts of new capacity, and we are going to need 100,000 or 150,000 replacement capacity, and if we are not going to avail ourselves of these new technologies, then we are going to be building flue gas desulfurization systems.

Mr. Cooper. I would like to get back to the choice that an old plant, a pre-1971 plant, would face choosing between scrubbers and clean coal technology. Is there any way that existing technology scrubbers could be as efficient, separating out the $NO_x$ question, as your fluidized bed process, to take that as an example of clean coal technology?

Scrubbers, as I understand them, are, by definition, less efficient than the new technology way to burn coal.

Mr. Disbrow. We believe that is right, yet to be proven.

Mr. Schwartz. I wouldn't completely agree with that. If you are talking about sulfur removal, yes, they may not get quite as much, but we are still talking about high removal levels. I mean you can still guarantee plus 90 percent sulfur removal in scrubbing systems, and yes, with integrated gasification combined cycle we may be talking about 99 percent, but nobody that I know of is talking about an acid rain type of bill that is going to get 90 percent removal. So as far as sulfur reductions, scrubbers can certainly play a role in it, and I don't think the efficiency difference is the only factor that makes you wait for clean coal technologies.

Mr. Disbrow. Speaking only for our own system, many of our pre-1970 plants are plants that are built on plant sites that we simply could not retrofit with scrubbers. We would have to shut them down if that were the only option, or fuel switch, to the extent we could, but even there many of those pre-1970 plants are built for a specific fuel, the boilers are built for a specific fuel, and to try to fuel switch, we couldn't do that either.

Mr. COOPER. So you are saying that on a number of AEP's pre-1970 plants you could not fuel switch and you could not use scrubbers.

Mr. DISBROW. We simply don't have the room to use the scrubbers. Now some of the other retrofit technologies are partial fixes, I think 40 to 70 percent removal, but our concern in those areas is that if Congress mandates—if we were to go forward with retrofit technologies at that level on some of the older plants, which are more cost-effective in my view from an economical and environmental trade-off, that we would then face even more stringent environmental requirements, which would force us to double up and invest yet more capital in trying to meet something such as new source performance standards. If we go with the partial retrofit solutions, like LIMB and so on, I believe we are going to need a safe harbor, because otherwise we may be just doubling the investment requirements.

Mr. COOPER. Mr. Yeager.

Mr. YEAGER. I would only add that, again, not to totally separate scrubbers from clean coal technology, some of the most important potential projects for clean coal technology have to do with scrubbing and improving the reliability and retrofitability of those techniques. Today they cost some $300 a kilowatt to retrofit, which is substantially more than the plant cost when it was new, if you are talking about the age of plants you are talking about.

Clearly, the operators and developers of scrubbers recognize that there are opportunities to improve that breed a good deal, and that is why it is an integral part of the clean coal initiative to come up with better and cheaper ways to do it. They will ultimately be available in the marketplace. They are not there today, and the costs and difficulties associated would be accordingly.

Also, I wish Mr. Swift were here because one of the realities of scrubbing is the by-product. A scrubber operating in a 1,000-megawatt plant burning 3 percent sulfur coal will typically produce about a square mile of sludge a foot deep for every year it operates. That covers the city of Seattle very quickly, if we were to move it out there.

Mr. COOPER. I'm sure Mr. Swift would appreciate that.

Mr. YEAGER. Solutions to those kinds of problems are also being developed, but they are not here in a broad sense today. So we would be freezing in a number of environmental side effects that I expect the same people who are pressing for the application of a technology today in 5 or 7 years would say, "Now why did you do it that way? We didn't want you to do it that way and produce all those problems in the account."

Mr. FEIRA. May I make a couple of points relative to the waste issue and the efficiencies of scrubbers. Scrubbers are highly efficient devices and remove in excess, well in excess, of 90 percent of the $SO_2$. A lot of the clean coal technologies will not do that.

As far as the waste issue is concerned, scrubbers are highly efficient users of reagents and will generally produce less waste than, for example, a fluidized bed combuster will.

Mr. COOPER. I thought you were going to dispute his figures about sludge in the city of Seattle. I thought the so-called Japanese scrubbers were much more efficient than the ones that you are describing and that we would not have as much of a waste problem using that newer technology as we would have using older scrubber technology.

Mr. YEAGER. That is precisely why they are included under the Clean Coal III proposals. The demonstrations on high sulfur coal where they have never been operated-rated under these conditions.

Mr. COOPER. One more question. For one of your plants that could be fit with scrubber technology, how much of a downtime would it take to install scrubbers. Are you talking about taking it out of commission for a month, 3 months?

Mr. DISBROW. Somewhere between 3 months and 5 months. It is a function of the specific plan. The geometry, the configuration of the plant, whether you can build this thing in isolation and then merely tie it in. Under the simplest conversion, 3 months, it could be as much as a year if you ran into complicated situations.

Mr. COOPER. Clean coal would take even longer?

Mr. DISBROW. If we went with it, it would have to be a proportionately longer time.

Mr. COOPER. Is there no technology that you are aware of that could be simpler to install?

Mr. DISBROW. Some of the partial removal situations would take less time.

Mr. SIEGEL. Also, for the repowering technologies, as well, one does not need to tear down the existing boiler before the, for example, pressurized combuster is built. We could build it if it is necessary, connect to the existing boiler and then tie in the system.

Mr. DISBROW. You have to look at it on a specific basis.

Mr. SCHWARTZ. In response to one of your earlier questions about saying, well, what do you do about the problems. It seems to me, having followed this for a little while, that they are where at one time a lot of proposals along the lines of more targeted proposals like Mr. Ruckelshaus had a proposal out to say if we are worried about emissions in the Northeast, maybe we should try to control them, rather than talking about emissions in Florida or elsewhere.

And that seems to have gone nowhere.

Mr. COOPER. Those of us in Tennessee are not just worried about the East, but we are worried about Smokey Mountain National Park which has 12 million visitors a year. The problem is perceived to have spread across a larger area than just the Northeast.

Mr. SCHWARTZ. There were also proposals targeted toward trying to be more efficient and force controls on the most efficient plans first, the H.R. 3400.

Certainly they could be modified to pick a little list. But the concept was trying to address some of what you raised, what can you do now as well, without precluding the value of clean coal technologies over the long term. So you have limited amounts now in a targeted way.

Some of those concepts I thought were out there in different ways.

Mr. COOPER. They may still be, it does not seem to be currently in vogue in this body. Maybe it will return to fashion. It is a lot like trying to solve a crime problem by only cracking down on murders, forgetting rapists or pickpockets, other aspects. And if you lived in a community with the 51st dirtiest plant, how would you feel then?

When you have some utilities affected and others not, you will have necessary problems.

If the gentleman from Pennsylvania would like to ask some questions, I would be happy to yield to him.

Mr. WALGREN. I had wanted to ask one thing, on whether there are differences in parts of the country that you foresee, in either scenario, either you do something near-term and you define what it is because of when you are doing it, or you leave it to the longer run, what differences do you see between my part of the country: Pennsylvania, Ohio Valley, and so forth versus the South or the West, in the pick up of new clean coal technology?

Do you have any projections or predictions for those areas? Are there going to be any differences been the Northeast and the South?

Mr. SCHWARTZ. The answer is probably yes, but it depends on what kind of legislation or control requirements are out there. If you are talking about a bill that allows switching to low sulfur coal, on a regional basis you will see a lot more fuel switching in the South in Mr. Cooper's area and a lot more retrofit of scrubber technology and other clean coal type of controls in your area in Pennsylvania, Ohio and Indiana. Largely due to the transportation issues of local high sulfur coal versus areas that are proximate to low sulfur coal.

But if you are talking about a bill that says you must have technology regardless, there won't be as many regional differences.

Mr. WALGREN. Anyone else want to comment?

Mr. SIEGEL. I should add, too, that not only might there be regional differences for retrofit or repowering to existing facilities but to new facilities as well. And those regions of the country that are undergoing large growth patterns, these new technologies will likely pop up.

The combined cycle coal gasification and pressured bed combustors, once they are commercially available, will start being utilized to a greater extent than in regions that aren't experiencing great amounts of growth.

Mr. YEAGER. I think you see the differences again when you separate clean coal technologies into those that are productive and intended to reduce costs, relative to those that are only intended to control cost increases.

Fluid bed combustion, which is in the former, is really turning out to be a rather—what I call equal opportunity coal technology in that it is being applied in high sulfur and low sulfur coal applications North, East, South and West. We are involved now in four fluid bed demonstrations and three of those four are indeed using western types of coal, so that its broad application there is very evident and because it is a more productive way of using coal as well as one that has environmental advances.

So that is just an example of the kind of thing that I think you would see in the coal arena.

Mr. WALGREN. You mention fluidized bed combustion technology. As I understand Mr. Disbrow, AEP has picked up on a demonstration of fluidized bed——

Mr. DISBROW. We have a project under way in Ohio and have a second repowering unit at solicitation number two.

Mr. WALGREN. Would things change for those projects if the Congress were to pass a near-term control bill?

Mr. DISBROW. I think we would automatically withdraw the second proposal. The first is under way and we would continue to learn as much as we could from it. When you reach the point of no return you won't cancel the project.

In Ohio, unlike most States in the Union, Mr. Oxley, and it did pass clean coal technology bond fund and they are showing it along with DOE. So out of 180 million, we are only on line for 110 million.

But in addition to that legislation to affect the 100 million bond issue, the State has allowed us to collect the other additional 110 million on a current basis. So that project will go regardless at this point.

The second project would be withdrawn if we had to meet.

Mr. WALGREN. Why?

Mr. DISBROW. Because we only have so many dollars to spend. And if we had to go with flue gas desulfurization, that is where we would concentrate our limited resources.

Mr. WALGREN. One other thought, if I might, Mr. Chairman.

Are we distinguishing between the large emitters and the small emitters in any way in your projections as to what would go forward and what would not go forward? Instinctively I wonder whether, if you leave a wide range of control to States, to comply with in whatever way they want to comply and pick up wherever they want to pick it up, compared to the mandated control on individual large emitters, would many of these technologies come forward for the small emitters, out of State compliance plans that might have a great amount of flexibility in them.

Mr. YEAGER. Yes, I would comment that the smaller emitters are likely to be the ones where you apply it first, because that is where you have the greatest confidence. The scale factor is smaller.

The risk on an individual utility or industrial application will be less so that I think that is where you see the applications and, in fact, most of the projects that are proposed under the clean coal initiative are initially on the smaller types of plants and then would move forward.

I see that as an integral step in the scale-up process so that we enter a position to apply those technologies confidently to the large units that are at the core of the fleet.

Mr. WALGREN. What you would anticipate happening is if you have a near-term control date which would require a scrubbing on large facilities but leaves a range of control to a State implementation plan, that the smaller technologies or small scales will, in fact, be demonstrated under State implementation plans and the large facilities will have to be scrubbed; is that not right?

Mr. YEAGER. I think once you have paraded that first step, that you now included in your position of requiring scrubbing or some level, medium level control on large plants, I think the whole initiative falls apart. And I would, I mean, that, Mr. Disbrow may expand on that but——

Mr. WALGREN. I guess my question is why would it fall apart if, in fact, there still would be the market pull, the need of many small emitters across the State to come into some future compliance reductions and there is no dictate as to method and even the time frame may very well be beyond, let's say, 1993 that has been proposed by some of these bills, why would the whole initiative fall apart?

Mr. YEAGER. Because it would not be going anywhere and you would probably go ahead and just switch fuels on those plants or retire them, rather than do anything in the way of a capital investment on them because there would be no carrot, if you will, for the technology to go anywhere, you get rid of those as quickly as you can.

Mr. WALGREN. The only carrot is the very large plant and you don't expect the significant market in smaller manufacturing combustion and the like?

Mr. DISBROW. To the extent the new technologies are, they may be used to repower older plants. And we are hopeful that we will be able to demonstrate in DOE, too. But the point is that if we start with flue gas desulfurization systems, our costs will go up and the cost of our ratepayers is going to go up.

We can ill afford at that point to experiment on that new technology which may or may not work. Because if it does not work, we will never get cost recovery. We will go with the proven.

Mr. WALGREN. Any other comments.

Mr. Schwartz.

Mr. SCHWARTZ. I don't think you are completely off base in terms of thinking about the fact that some of the small units are markets or for the clean coal technologies, I think Mr. Yeager was correct when he said, in fact, that at today's development and technology they currently are most applicable on small sizes and there are other reasons to think that the small sized boilers—I think when you are talking about going down to manufacturing facilities, you are going well beyond where the economics will support it.

You are talking about pushing natural gas, quite honestly, if you are talking about things like State institutions in Pennsylvania. They won't put scrubbers there.

But still on the small sizes, scrubbers tend to be more expensive, and also fuel switching in locations that are not convenient to low sulfur coal like in Pennsylvania, gets exorbitantly expensive because the transportation costs are even greater on small boilers than large boilers, and there is a market niche for these technologies in smaller sizes.

Now I am not trying to disagree with everything, but I don't think your point is completely out of line in what you are trying to achieve or think through.

Mr. WALGREN. Thank you, Mr. Chairman.

Mr. COOPER. I thank the gentleman from Pennsylvania. It was my understanding that earlier in the hearing some of the witnesses, I think Mr. Siegel, Mr. Yeager and Mr. Sprague, perhaps touched on the issue of what regulatory reforms could be implemented that would encourage utilities to be greater risk-takers in these areas to explore new ventures, would you care to elaborate on those ideas either now or for the record later in writing, Mr. Siegel?

Mr. SIEGEL. I did point out earlier in my testimony that the President's Task Force on Regulatory Relief did, in fact, look at the issue and came up with several recommendations. Several of these are rate-making issues that might provide incentives, full construction work in progress, incentive rates of return and accelerated amortization that might provide the rewards that utilities might need to take risks in building the first or second of a kind of technology.

In addition, there were some recommendations on current incentives EPA could use, bubbling of plants, for example, that might also encourage first of a kind demonstration and initial deployment. There is an advisory group to the Department of Energy which at the present time is looking at a very broad range of positive incentives that could be applied both at the Federal and State levels.

That advisory group is planning on providing a report to the Department on that subject by October of this year.

Mr. COOPER. I don't know how familiar all of the gentlemen are with the various acid rain proposals that have been put before Congress, but would any of you like to vote for the least obnoxious proposals?

At this time, Mr. Sprague, would you like to comment?

Mr. SPRAGUE. Well, we stated in our testimony that we thought if the Congress passed acid rain legislation, that they should consider the clean coal technology and a phased-in approach would be one of the best ways to go so that you would have some incentives to see that that technology was used.

Mr. COOPER. Any other folks have a least-obnoxious candidate?

If I could ask one final question. The Celeste-Cuomo bill has intrigued me. Did Governor Celeste consult you on that agreement and what you think of that agreement?

Mr. DISBROW. I have had many conversations with Governor Celeste as to the emissions and so on, in terms of Governor Celeste, in apparent agreement with Cuomo, there was no discussion before. A brief 2 weeks before that, the State legislature in Ohio past unanimously with one dissenting vote in the House of Representatives, an ex-Federal Congressman that felt that State legislatures should not seek to express their will to the U.S. Congress, past a resolution asking the congressional delegation from Ohio to oppose acid rain legislation at all costs.

Apparently, there is not too much communication between the Governor and the legislature.

Mr. COOPER. That is an interesting divergence of views. You say it was almost unanimous?

Mr. DISBROW. One dissenter in the House. He was a former U.S. Congressman and felt that it was inappropriate, an inappropriate action for State legislature to take. So he dissented.

Mr. COOPER. That is an interesting sideline. I appreciate the excellent testimony of the witnesses and your patience.

Thank you very much.

[Whereupon, at 4:13 p.m. the hearing was adjourned.]

[The following statement was received for the record:]

# STATEMENT OF
# AMERICAN GAS ASSOCIATION
# BEFORE THE
# SUBCOMMITTEE ON ENERGY AND POWER
# COMMITTEE ON ENERGY AND COMMERCE
# UNITED STATES HOUSE OF REPRESENTATIVES
# ON ACID DEPOSITION CONTROL
JUNE 22, 1988

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## INTRODUCTION

The American Gas Association (A.G.A.) is a national trade association comprised of some 250 natural gas distribution and transmission companies serving over 166 million natural gas consumers throughout the United States.

There are a number of often overlooked natural gas utilization technologies which are easily implemented and offer an economical way of reducing sulfur oxide ($SO_x$), nitrogen oxide ($NO_x$) and emissions from other pollutants. A.G.A. hopes that any acid deposition control bill would recognize the role natural gas can play as a control option.

A renewed emphasis on environmental protection through the amelioration of acid deposition dictates that all environmental compliance options should be analyzed to determine the most cost effective methods for reducing emissions. Acid rain control proponents often focus only on coal cleaning through flue gas desulfurization (scrubbing) as the primary means of reducing sulfur oxide emissions. However, natural gas utilization technologies, often in conjunction with other clean air technologies, represent some of the most cost effective and efficient environmental compliance alternatives.

Since the most efficient control strategy for a particular plant depends on factors unique to that plant, it makes sense to give plant operators sufficient flexibility to choose among the most cost effective compliance alternatives for their sites. As long as environmental goals are met, natural gas utilization technologies should be left to compete in the open market with other, more traditional methods of reducing $SO_2$.

Therefore, A.G.A. hopes that the following recommended general principles are incorporated into any acid deposition control legislation that may be addressed.

## A.G.A. RECOMMENDATIONS FOR ACID DEPOSITION CONTROL LEGISLATION

- Favor Discretionary Emission Reduction Measures

  Emission limits should be set at a reasonable level that all technologies and fuels must meet, rather than mandating specific control technologies to be used on a particular source, or emission rates which vary by fuel type. This approach would allow environmental goals to be reached in a more economical and efficient manner than, for example, mandating continuous technological controls such as scrubbers. Moreover, discretionary emission reduction measures would enable those who are in the best position to determine what is technologically and economically feasible for the specific plants -- the plant operators -- to make the choice of emissions reduction measures. Most importantly, this approach would not legislatively preclude the potential contribution of natural gas, the substitution of which may provide the simplest and most economic means of reducing $SO_2$, $NO_x$, and other pollutants.

- Oppose Across the Board Taxes on Emissions

  Companies that already have instituted measures to reduce harmful emissions from their sources should not be made to pay again through the imposition of a flat tax on all sources. No law should impose taxes that would have an unnecessarily disproportionate effect on clean utilities. Polluters should be responsible for their own control measures and we would oppose any tax that collects significant funds from one company to subsidize cleanup by another company that has not yet initiated its own measures. However, if Congress insists on a tax on emissions, it should be scaled according to the amount of actual emissions rather than charging each particular source the same tax.

- The Discretion of Setting New Source Performance Standards Should Be Left to EPA

  The revision or promulgation of New Source Performance Standards (NSPS), or any other standards, should be left up to the discretion of the Environmental Protection Agency (EPA) and should be accomplished through the traditional rulemaking process. Section 111 of the Clean Air Act has adequate requirements for revising NSPS that have been effective for many years. There is no reason to revise or reword the language at this time. The Clean Air Act directs that standards be keyed to demonstrated technology and EPA is constantly evaluating new technologies to determine if new standards are justified. Standards must not be promulgated without regard to technological and economic feasibility. Congress has traditionally left this to EPA and any clean air legislation should continue to reflect this.

- Appropriations Should Not Be Limited to "Clean Coal" Technology

  If legislation contains provisions for the authorization and appropriation of funds for a "clean coal" technology program, it should not be limited to traditional clean coal technologies. Rather, a broad technology development program should be instituted to assist any fledgling innovative technology which, when used on existing plants, may significantly reduce harmful air emissions. This approach would not legislatively exclude the select use of gas through reburn, co-firing, seasonal substitution or other means. All new technologies that can significantly reduce emission levels should be allowed to compete fairly. Restricting funds for new clean burning technologies is counterproductive, requiring taxpayers and ratepayers to subsidize non-economic technologies.

- Favor Flexibility for Trading and Bubbling

  Provisions allowing for emissions trading and bubbling should be permitted. Bubbling allows a source to reduce control requirements at one point by increasing control correspondingly at another as long as an aggregate emission level is not exceeded. The bubble may be applicable either within a single plant or between different plants in the same area. With the high cost of environmental compliance, as long as total actual emissions are reduced by the mandated amount, maximum flexibility should be permitted.

- Oppose Statewide Noncompliance Penalties

  If a state fails to submit or enforce a state implementation plan, it is unfair to assess noncompliance penalties on each source. Companies should not be responsible for the lack of action by the state. This scheme would unduly discriminate against sources that have taken measures to control their emissions.

- Favor Seasonal Control Options

  The goal in acid deposition control legislation should be to reduce annual tonnage of $SO_2$ and/or $NO_x$ emissions, irrespective of when these reductions occur. For instance, a plant reducing emissions by 200 tons per month for six months with no reductions in the remaining 6 months of the year should be considered at least as effective as a plant reducing by 100 tons per month for each of 12 months. In fact, scientists from the Massachusetts Institute of Technology and others have shown that seasonal control of pollutants can be more effective than year-round controls.

## NATURAL GAS USE IN STATIONARY SOURCES FOR $SO_2$ REDUCTION

### Select Gas Use

"Select use" is the general term that refers to the use of natural gas to control and regulate emissions associated with burning other fossil fuels. A few of the recognized select use methods include: 1) "co-firing," in which natural gas is burned simultaneously with another fossil fuel in the same combustion chamber; 2) "reburning," in which natural gas is injected into the upper elevation of a furnace to achieve nitrogen oxide ($NO_x$) reduction and more complete combustion; 3) "bubbling," in which some combustion units are operated entirely on natural gas while other nearby units are operated on some other fuel and the emissions of the adjacent units are averaged in order to meet emissions standards; and 4) "seasonal or episodic substitution," where natural gas is substituted for higher polluting fuels on a seasonal or episodic basis, in order to combat pollution episodes during seasonal peaks. Some of these methods will be described later in more depth.

The select use option offers a number of advantages to both plant operators and the nation as a whole. The first advantage is an economic one for the user. Select use methods tend to have low capital requirements, and, in many instances, the lowest total costs compared to other control strategies (e.g., scrubbers). For example, the cost of $SO_2$ control with select use of gas in the U.S. has been calculated to be as low as \$50/ton of $SO_2$ removed, with many potential sites in the \$200-\$400/ton range.1/ Of course, the cost per ton depends on the relative fuel prices. By comparison, the cost of alternative control strategies ranges from \$250/ton to over \$2,000/ton.2/

The second advantage is that natural gas has the ability to reduce emissions of $SO_x$, $NO_x$, reactive hydrocarbons (NMHC), particulates, carbon monoxide (CO), and carbon dioxide ($CO_2$) simultaneously in existing stationary sources. In addition, gas combustion produces little or no ancillary pollution, *e.g.*, sludge, ash or residue, in sharp contrast to other options, *e.g.*, the scrubber/precipitator option. These attributes of natural gas use make it the ideal choice to combat ozone, carbon monoxide and acid deposition, as well as to eliminate a solid waste disposal or water treatment problem, especially in space-constrained urban locations.

The third advantage is that natural gas can be used in conjunction with other domestic resources, including Eastern high sulfur coal and Western low sulfur coal, which helps to ensure that national environmental goals will not be achieved at the expense of a major domestic industry and its many employees. In fact, it has been estimated that $SO_2$ reductions of nearly 70 percent could be achieved via the washing of certain high sulfur coals combined with select use of gas, while still permitting the high sulfur coal to comprise as much as 70 percent of the total fuel mix.[3/]

Related to this is the advantage of select use of gas being capable of quick response to both environmental and economic problems. Most large fuel-burning installations are multi-fuel capable, and many already have gas burning capability. Thus, select use can be employed immediately, whereas technology-based options require many years for equipment design, testing, and installation.

The concept of select use has been accepted by the current Administration. The President's Task Force on Regulatory Relief, chaired by Vice President Bush includes as an initiative that EPA will encourage states to use "bubbles," rather than merely accept them in SIPs. This concept was also included in the President's "Administrative Message to Congress" of January 1988.

## Gas-Fired Cogeneration

Gas-fired cogeneration systems, which produce both electrical (or mechanical) energy and thermal energy, are an attractive option from both an energy efficiency and an environmental standpoint. According to the U.S. Office of Technology Assessment, a gas turbine cogeneration system sized correctly would require approximately 25 percent less input energy than the combination of a new coal-fired electric powerplant and an oil-fired boiler producing equivalent quantities of steam and electricity.[4/] In addition, when compared to a similarly sized conventional coal- and oil-based system, with traditional pollution control equipment, the gas-fired cogenerator would typically emit 99 percent less $SO_x$, 50 percent less $NO_x$, and 73 percent fewer particulates.[5/]

Using gas-fired cogeneration systems for environmental compliance will yield the following additional benefits: 1) substantial energy savings relative to conventional separate electric and thermal energy technologies; 2) relatively low capital cost; 3) facilitation of siting new generating capacity due to the small unit size; and 4) insurance against short-term fluctuations in electricity demand growth.

## Combined Cycle Gas Turbine Powerplants

A combined cycle gas turbine powerplant combines the operation of a gas turbine, a steam turbine and a heat recovery steam generator for electricity generation. These systems have an advantage over central powerplants because they can be installed in a short period of time (2 to 3 years versus 8 to 15 years for coal and nuclear units), and they may be brought on-line in relatively small incremental blocks. Its modular construction feature offers great flexibility to utility planners and effectively reduces the amount of capacity which must be added to provide the same system reliability. Further, the relatively low capital cost of combined cycle units ($500-$700 per kilowatt or about one-third the cost of a new coal-fired unit)[6/] reduces financial uncertainties and risks.

The environmental features of gas-fired combined cycle powerplants are substantial. They typically produce 57 percent of the $NO_x$, and less than 0.3 percent of the $SO_2$ of similarly sized coal-fired units that are equipped with pollution control equipment.[7] In addition, they produce no sludge or ash, and require half as much treated water as coal units. Because combined cycle gas turbine powerplants are environmentally clean, utilities have much more flexibility in siting them than central powerplants, e.g., utilities can build near load centers, thereby minimizing transmission costs and enhancing system reliablity.

## Seasonal Substitution

The substitution of natural gas for higher sulfur fuels on seasonal basis is another effective method of reducing acid deposition. Since the summer season is typically the most serious in terms of acid deposition (70% of acid deposition falls in the six summer months) and ozone episodes, substituting gas in the summer, as opposed to all year-round, may be more effective in alleviating the problem. Seasonal gas substitution would save money for gas and electricity consumers by allowing gas distributors and pipelines to increase their capacity utilization during the non-heating season while directly addressing the acid deposition and ozone problems when they are most serious.

## Co-Firing

Co-firing gas and coal in the same boiler offers a variety of environmental and operational benefits. Not only does the use of small quantities of natural gas (typically

5-20%) in conjunction with coal reduce emissions of sulfur dioxide, nitrogen oxides, particulate matter, sludge, ash and other pollutants, but it can also enhance boiler performance and result in lower maintenance costs and fewer plant breakdowns. Co-firing also can be instituted at very low capital costs while improving the combustion of our domestic coal.

## CONCLUSION

Because of the long-term availability of natural gas in the U.S. and North America, its acknowledged clean-burning characteristics, and its extensive in-place delivery infrastructure, the use of natural gas for environmental compliance is an attractive option in many applications.

Therefore, A.G.A. respectfully urges you to include our recommendations in any acid deposition control legislation so that natural gas utilization technologies are not excluded as potential compliance options.

## FOOTNOTES

1/ A.G.A. Issue Brief 1986-9, Natural Gas and The Environment at 2 (March 14, 1986).

2/ Larry Parker, Congressional Research Service, Mitigating Acid Rain: Implications for High-Sulfur Coal Regions at CRS-11 (May 16, 1983).

3/ Issue Brief, *supra* note 1 at 3.

4/ U.S. Office of Technology Assessment, Congress of the U.S., Industrial and Commercial Cogeneration at 286-287 (February 1983).

5/ *Id*.

6/ A.G.A. Energy Analysis 1985-9, Natural Gas-Fueled Combined Cycle Electric Power Generation -- An Attractive Option at 2-4 (May 10, 1985).

7/ *Id*. at 16.

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